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INVESTIGATIONS IN PASTURE PRODUCTION.

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II. EXPERIMENT AT MARTON ON EFFECT OF APPLYING SUPERPHOSPHATE AND BASIC SLAG AT DIFFERENT TIMES OF YEAR.*

(1) GENERAL DESCRIPTION.

THE experiment described in this article was carried out at the experimental area of the Department of Agriculture at Marton. The object was to determine the effect of applying superphosphate and basic slag respectively at different times of the year. The results for a period of three years, from 16th August, 1928, to 14th August, 1931, are presented.

The technique adopted was only slightly different from that described in the first article of this series (see *Journal* for August, 1931). A modification of technique, described in the first article, was made at the end of August, 1930, or about the commencement of the third year of the trial. The effect of this modification will be referred to later.

The pasture was sown down in March, 1925, with the following seeds mixture per acre: Perennial rye-grass, 15 lb.; Italian rye-grass, 15 lb.; red clover, 3 lb.; white clover, 2 lb.

Hay crops were cut in 1926 and 1927. It was not intended to leave the pasture down for a long period, but at the time of commencing the investigation in August, 1928, it looked to be reasonably good in perennial rye-grass. Under the system of management of the investigation, however, the amount of rye-grass was reduced. In the light of demonstrations at Marton by Deem of the differences in type and persistence of perennial rye-grass from different sources within New Zealand, and the recent conclusive work of Levy and Davies (see this *Journal* for June, 1930), it is obvious that this was

* A fuller description and more detailed record of this experiment is being published as Bulletin No. 31 of the Department of Scientific and Industrial Research.

due more to the type of rye-grass than to the system of management. The perennial rye-grass was of Southern origin and evidently one of the "false" perennials described by Levy and Davies, which under a system of haying re-established by seeding; but, when not permitted to seed, its inability to persist was evident. Consequently, more volunteer species, chiefly sweet vernal and catsear, contributed to the botanical make-up of the sward during the latter part of the period of investigation.

The manuring prior to the trial consisted of an application of 2 cwt. per acre of superphosphate when the pasture was sown in March, 1925, and a further application of 2 cwt. in July, 1926.

(2) Date of commencing Investigation and Treatments under Trial.

The initial application of the fertilizers under trial was made on 1st August, 1928. The fencing of the areas and the preliminary mowing to even up the general height of the herbage was completed on 16th August, and it is from this date that the records commence. The treatments were:—

No. 1: No manure.

Nos. 2 to 5 inclusive: Superphosphate at 3 cwt. per acre in the winter, spring, summer, and autumn respectively.

Nos. 6 to 9 inclusive: Basic slag at 3 cwt. per acre at the same times as the superphosphate.

The superphosphate was the common commercial grade, containing 44 to 46 per cent. tricalcic phosphate (about 20·6 per cent. phosphoric anhydride). The slag was a finely ground highly citrate-soluble material, registered as containing 17–20 per cent. phosphoric anhydride.

It was decided to compare the two fertilizers on an equal weight-per-acre basis, as representing farmers' practice, rather than to adopt a comparison of equal quantities of phosphoric anhydride.

Each of the fertilizer treatments was replicated eighteen times and the no-manure plots twenty-four times, giving 168 plots in each of triplicated areas. This gave a fairly high degree of accuracy.

(3) Dates of Application of Fertilizer.

Applications of fertilizers were made at quarterly intervals as near as dates of cutting would permit, each application being made a day or two after a cutting as a rule. Table 1 shows the actual dates on which the fertilizers were applied.

Table 1.—Showing Actual Dates on which Fertilizers were applied.

Season.	Dates of Applications of Super and Slag.			
	Winter Application.	Spring Application.	Summer Application.	Autumn Application.
1928–29 ..	1 Aug., 1928	1 Oct., 1928	4 Jan., 1928	4 April, 1929.
1929–30 ..	3 June, 1929	6 Sept., 1929	2 Dec., 1929	4 Mar., 1930.
1930–31 ..	12 June, 1930	3 Sept., 1930	13 Dec., 1930	3 Mar., 1931.
1931–32 ..	3 July, 1931	..	..	..

(4) Botanical Composition of the Pasture.

Botanically, the pasture must be regarded as a poor one, although fairly representative of a large number of pastures on similar country. The main constituents were rye-grass, white clover, sweet vernal, cats-ear, and Poa annua. Other species present in smaller amounts were *Agrostis* species (such as brown-top), cocksfoot, crested dogstail, Yorkshire fog, and goose-grass.

Usually grasses were most prominent in the period from early May to early December, and white clover was responsible for most of the production from December to April inclusive. After the first year of the

GENERAL VIEW OF THE TRIPLICATE AREAS OF THE EXPERIMENT AT MARTON.
[*Photo by H. Drake.*

trial the rye-grass was considerably reduced as a result of the inability of the poor type to stand up to conditions which did not permit re-establishment by seeding.

Super promoted growth of both grass and clover. Slag tended to be rather specialized in its effect, in that clover growth was increased without a corresponding increase in grass growth.

(5) Number of Cuts (= Growth Periods) and Periods between Cuts.

A total of 45 cuts (about 15 from each of the triplicate areas) were weighed during the three years from 16th August, 1928, to 14th August, 1931. These were distributed as follows: 1928–29, 15 cuts; 1929–30, 14 cuts; 1930–31, 16 cuts.

The periods between successive cuts ranged from ten days to 108 days, according to the season of the year. During periods of relatively

high production in the spring and summer from ten to twenty days usually elapsed between cuts. As stated in Section 5 of the first article, weather conditions and the growth of the longer patches of herbage had a considerable influence on the actual time of cutting. Periods between cuts in the 1928–29 and 1929–30 seasons, during the autumn and winter months, were unduly prolonged as a result of a weakness in the technique, which was eliminated in the 1930–31 season.

(6) Rate of Growth at different Times of Year.

The following remarks apply to the yields of green herbage from the no-manure plots. With the exception of one growth period, when slag fell away in production, both super and slag caused increases in yield throughout the whole of the period over which they were applied.

Season 1928–29.—The highest production during this season occurred between the 21st and 31st December, 1928, when the no-manure plots yielded at the rate of 142 lb. of green herbage per acre per day. The period 28th September to 9th October, 1928, showed the next highest production of 131 lb. per day. The lowest rate of production was 6·4 lb. per day from 3rd April to 22nd May, 1929. Production over the year fell into two fairly well-defined periods—the high-production* period extending from 11th August, 1928, to 29th January, 1929, and the low-production period from 29th January to 5th September, 1929.

Season 1929–30.—In this season very rapid growth occurred between the 30th September and the 11th October, 1929, when the no-manure plots yielded 228 lb. per acre per day. Production during late October and early November and during December was below that of the previous year, but a flush occurred again between the 10th and the 24th January, 1930, when 166 lb. per day was recorded. Production then fell away rapidly with dry weather in February and March, until the lowest period of 3·9 lb. per day was reached between 24th February and 12th May, 1930. The high-production period extended from 5th September, 1929, to 4th February, 1930, and the low period from 4th February to 28th August, 1930.

Season 1930–31.—The period of highest production in this season occurred between the 28th November and the 11th December, 1930, when 208 lb. per acre per day was produced. The autumn production in this season was better than in the previous one, due largely to a very favourable autumn, and in part to the modification in technique mentioned previously, giving a more accurate measure of production. The lowest production occurred between 11th May and 1st July, when an average of 11·9 lb. per day was produced. The high-production period extended from the 28th August, 1930, to the 27th February, 1931, although in late September and early October production fell to 34 lb. per acre per day. The low period extended from the 27th February to the 14th August, 1931.

Considering the three seasons under review, it seems that a marked flush of growth is likely to occur any time during the October to

* " High production " is a relative term only, and indicates that production was greater than 45 lb. per acre per day of green herbage. Low production represents that below 45 lb. per acre per day.

January period. An abundant supply of moisture, together with an absence of cold winds, usually give rise to high rate of growth. In each season production fell into fairly well defined relatively high- and low-production periods.

(7) Total and Relative Production of Freshly-cut Herbage for each of the Three Years of the Trial.

Table 2 shows the production for each of three years for each of the treatments. Figures for plots receiving spring, summer, and autumn applications are not shown in the first year because these were manured for portion of the year only.

Table 2.—Showing Total Production in Pounds per Acre of Freshly-cut Herbage, and Relative Production (no Manure = 100) for each Treatment for each of the Three Years.

Period.	No Manure.	Superphosphate applied.				Slag applied.			
		Winter.	Spring.	Summer.	Autumn.	Winter.	Spring.	Summer.	Autumn.
	lb. p. ac.	lb. p. ac.	lb. p. ac.	lb. p. ac.	lb. p. ac.	lb. p. ac.	lb. p. ac.	lb. p. ac.	lb. p. ac.
Production from 16th Aug., 1928, to 5th Aug., 1929	18,084	23,630	*	*	*	21,814	*	*	*
Relative yields	100	130·7	*	*	*	120·6	*	*	*
Production from 5th Aug., 1929, to 28th Aug., 1930	17,465	25,017	25,734	27,216	26,451	23,606	22,405	23,054	22,681
Relative yields	100	143·2	147·3	155·8	151·4	135·1	128·2	131·9	129·8
Production from 28th Aug., 1930, to 14th Aug., 1931	18,927	26,861	27,430	27,516	27,791	24,625	24,140	24,150	24,569
Relative yields	100	141·9	144·9	145·3	146·8	130·1	127·5	127·5	129·8

* Plots not manured for whole of period.

Comments on Table 2.

The periods chosen are as near annual ones as dates of cutting would permit. The yields from no-manure plots fell away slightly in the second year compared with the first; the results from the winter application of super and slag were decidedly better in the second year (1929–30), and although this represented a thirty-three-day longer period than the first (1928–29) year the difference is greater than could be accounted for by the longer period. In the third (1930–31) year all treatments have yielded better than in the previous year or years, although the period is thirty-seven days shorter than the previous one (1929–30). This is thought to be due in large part to the modification in technique (Section 5 of August *Journal*).

All superphosphate treatments have yielded considerably better than the slag treatments. This is most easily seen in the relative yields. The plots receiving summer and autumn applications have yielded respectively 55·8 and 51·4 per cent. better than no-manure in the 1929–30 year, and are superior to all other treatments. They are again the best-yielding treatments in 1930–31, although the superiority over the other superphosphate treatments is much less marked than in the previous year.

(8) Relative Production of all Treatments for Different Twelve-monthly (approximately) Periods.

It is difficult to compare the effect of a winter dressing of manure with, say, a summer one, in so far as the total production over a year is concerned. The year as a whole immediately following the application of one of these treatments may be a more favourable one than the year as a whole following the other. By taking a number of twelve-monthly periods, however, the tendency must be to eliminate the effect of particularly favourable or unfavourable seasons, and if an application at one time is better than an application at another time on total annual production, its superiority should show in most of the periods at least. Table 3 shows the relative yields for different twelve-monthly (approximately) periods. During each period chosen all manured plots have received one and only one application of manure. Each period extends from the date of the last cut preceding an application of manure to the last cut preceding the next application in the corresponding quarter of the year. The periods selected commence with one beginning on the 3rd April, 1929. All manured plots had received one dressing by the 4th April, 1929.

Table 3.—Showing Relative Total Production of Freshly-cut Herbage from all Treatments for Different Twelve-monthly (approximately) Periods. (No Manure = 100.)

Period.	No Manure.	Superphosphate applied.				Slag applied.			
		Winter.	Spring.	Summer.	Autumn.	Winter.	Spring.	Summer.	Autumn.
3rd April, 1929, to 24th February, 1930	100	141·5	145·4	152·6	145·5	133·6	127·6	131·3	127·0
22nd May, 1929, to 12th May, 1930 ..	100	141·6	145·2	152·6	146·3	133·9	127·5	132·1	127·1
5th Sept., 1929, to 28th Aug., 1930 ..	100	141·7	146·7	154·5	150·1	134·1	127·6	131·8	129·4
26th Nov., 1929, to 11th Dec., 1930	100	142·5	147·2	149·2	145·7	131·5	127·8	129·0	129·8
24th Feb., 1930, to 27th Feb., 1930 ..	100	143·1	144·9	144·8	147·9	130·6	127·2	125·9	130·2
12th May, 1930, to 1st July, 1931 ..	100	145·1	147·4	149·6	152·7	131·8	128·5	127·6	132·0
Average	100	142·6	146·1	150·5	148·0	132·6	127·7	129·6	129·2

Comments on Table 3.

The figures in Table 3 show a marked superiority of all manure treatments over no manure, and a consistent and marked superiority of super over slag.

Of the super applications the winter one has proved least effective, and the summer and autumn applications most effective, on total production over the year.

Consideration of errors associated with results leads to the conclusion that the superiority of the summer and autumn dressings—over the winter one, at least—are outside the limits of error associated with the measurement of relative production. In view of later discussion on the effect of the different treatments on the distribution of production between high- and low-production periods, the important point is that the summer and autumn treatments of super *have not produced less* than the others

The winter dressing of slag has been the most effective of the slag treatments in increasing yield, and the spring dressing the least effective. Differences between slag treatments are less marked than differences between super treatments, however.

(9) Effect of Treatments on Relationship of Production during High-production Period to Production during Low-production Period.

In Section 3 of the previous article (August, 1931) one of the objects of the investigations undertaken was stated as being the determination of method of applying fertilizers best suited to increasing production *particularly during periods of naturally low production.* It was stated previously in the present article that rate of production has fallen, more or less, into fairly well defined relatively high- and low-production periods.

In Table 4 the total production for three twelve-monthly (approximately) periods is shown, together with the percentages of these totals occurring during high- and low-production periods. For purposes of this analysis high-production periods represent all growth periods in which

Table 4.—Showing Total Production in Pounds per Acre of Freshly-cut Green Herbage for Three Twelve-monthly (approximately) Periods, and Percentage of Total Production occurring in High- and Low-production Periods respectively.

Periods.	No Manure.	Superphosphate applied.				Slag applied.			
		Winter.	Spring.	Summer.	Autumn.	Winter.	Spring.	Summer.	Autumn.
Production, in pounds, from 16th Aug., 1928, to 5th Sept., 1929	18,713	24,787	*	*	*	22,838	*	*	*
Percentage of total production occurring from 16th Aug., 1928, to 29th Jan., 1929†	86·2	83·7	..	..	..	85·2	..	..	..
Percentage of total production occurring from 29th Jan., 1929, to 5th Sept., 1929‡	13·8	16·3	..	..	..	14·8	..	..	..
Production, in pounds, from 5th Sept., 1929, to 28th Aug., 1930	16,836	23,861	24,710	26,014	25,272	22,581	21,480	22,188	21,788
Percentage of total production occurring from 5th Sept., 1929, to 4th Feb., 1930†	87·3	85·1	85·5	84·2	82·9	86·5	87·1	86·2	85·4
Percentage of total production occurring from 4th Feb., 1930, to 28th Aug., 1930‡	12·7	14·9	14·5	15·8	17·1	13·5	12·9	13·8	14·6
Production, in pounds, from 28th Aug., 1930, to 14th Aug., 1931	18,927	26,861	27,430	27,516	27,791	24,625	24,140	24,150	24,569
Percentage of total production occurring from 28th Aug., 1930, to 27th Feb., 1931†	79·8	78·4	77·8	76·3	75·6	78·6	78·8	77·8	78·1
Percentage of total production occurring from 27th Feb., 1931, to 14th Aug., 1931‡	20·2	21·6	22·2	23·7	24·4	21·4	21·2	22·2	21·9

* Plots not manured for whole of period. † = High-production period. ‡ = Low-production period.

the yield from the no-manure plots was 45 lb. per acre per day or more of green herbage. Low-production periods include growth periods when the rate of production was less than 45 lb. per acre per day on the no-manure plots. (Note.—From 23rd September to 7th October, 1930, a growth period yielding at the rate of 34 lb. per acre per day is included in the high-production period.)

Comments on Table 4.

It is not possible to fairly determine the ratio of production of high to low periods for all treatments in 1928–29, because it was only those plots receiving a winter dressing which were manured for the whole of this period.

In 1928–29 the winter application of super shows a greater percentage of its total production in the low-production period than does slag. Both are superior to no manure in this respect.

In 1929–30 all manure treatments show a greater percentage of their production during the low-production period than does no manure. The autumn and summer applications of super are most outstanding in this respect.

In 1930–31 the relationship of treatments to one another is much the same as in the previous year. A considerably greater proportion of the total production occurs during the low-production period in 1930–31 than is the case in the two previous seasons, and this in spite of the fact that this period is shorter in 1930–31. This is due mainly to the very favourable autumn growth in 1931, and in part possibly to the modification in technique as mentioned earlier.

Determinations of dry matter in the herbage were commenced with the May cut in 1930.* When the relationship of production in the high to the low period is expressed in terms of dry matter per acre, the percentage of the production during the low period is a little higher than is indicated by the figures for green herbage. This is due to the fact that there was, generally speaking, a lesser amount of dry matter in the herbage in high (rapid-growth) periods than in low (slow-growth) periods.

It is obvious from the figures presented that super lends itself better to manipulation of applications so as to spread production more evenly over the year than slag does under conditions such as those at Marton.

(10) Effect of Treatments on Production during the Period in which Pastures are normally closed up for Silage or Hay.

The period representative of the normal time of closing for silage or hay is taken, as near as cutting dates will permit, from late September or early October to about the second week in December. The closing and cutting dates vary according to individual cases, and, on account of generally unfavourable December weather, it is probable that early January is a more favoured time for making hay than December in the Wellington Province. By January it is usual for herbage to be overmature, however, resulting in inferior-quality hay. The periods chosen are therefore more representative of the "silage period" than the "hay period" as practised. Table 5 presents the data obtained.

* These are presented in the bulletin of the Scientific and Industrial Research Department previously noted.

Table 5.—Showing Production in Pounds per Acre of Freshly-cut Green Herbage, and Relative Production from Different Treatments (no Manure = 100) for the "Silage" or "Hay" Periods.

Period.	Yields in Pounds per Acre of Green Herbage and Relative Yields (the latter in Italics). (No Manure = 100.)								
	No Manure.	Superphosphate applied.				Slag applied.			
		Winter.	Spring.	Summer.	Autumn.	Winter.	Spring.	Summer.	Autumn.
Production from 28th Sept. to 8th Dec., 1928	6,977	8,705	9,086	*	*	8,453	8,579	*	*
Relative yields	*100*	*124·8*	*130·2*	..	..	*121·1*	*122·9*	..	..
Production from 30th Sept. to 11th Dec., 1929	6,746	9,358	10,010	9,331	9,892	9,244	8,791	8,644	8,917
Relative yields	*100*	*138·7*	*148·3*	*138·3*	*146·6*	*137·0*	*130·3*	*128·1*	*132·1*
Production from 7th Oct. to 11th Dec., 1930	8,074	11,333	11,843	10,621	11,091	10,461	10,334	9,659	10,343
Relative yields	*100*	*140·3*	*146·6*	*131·5*	*137·3*	*129·5*	*127·9*	*119·6*	*128·0*

* Plots not manured at this time.

Comments on Table 5.

The spring application of super has proved consistently better than all other treatments (super or slag) in effect on yield during the "silage" or "hay" periods. Of the slag treatments the winter application has proved most effective in the 1929 and 1930 periods, although its superiority over the spring and autumn applications was not marked in the 1930 period. In 1928 there is very little difference between the winter and spring applications of slag. All super treatments have proved superior to slag at corresponding times of application.

(11) Effect of Treatments on Production in Autumn Period from beginning of February to middle of May, approximately.

The late summer and autumn period has proved a period of comparatively little growth at Marton, due to low rainfall in February and March, and in part perhaps to the natural tendency for grasses to fall away in production. Table 6 (next page) shows the effect of the various treatments during this period.

Comments on Table 6.

The summer application of super has proved outstandingly more effective than all other treatments during the "late summer and autumn," except in the 1931 period, when the autumn application has almost equalled it. Up to the end of March of 19 1 the summer application was decidedly superior, but a rapid response following an application on 3rd March over a period of quite good April and early May growth enabled the autumn application to catch up in total production over the period.

It is only in the 1930 autumn that one of the slag applications (the summer one) is outstandingly better than the others.

Table 6.—Showing Production in Pounds per Acre of Freshly-cut Green Herbage and Relative Production from the Different Treatments (no Manure = 100) for the "Late Summer and Autumn" Period.

Period.	Yields in Pounds per Acre of Green Herbage and Relative Yields (the latter in Italics). (No Manure = 100.)								
	No Manure.	Superphosphate applied.				Slag applied.			
		Winter.	Spring.	Summer.	Autumn.	Winter.	Spring.	Summer.	Autumn.
Production from 29th Jan. to 22nd May, 1929	1,275	1,617	1,637	1,931	1,509	1,349	1,463	1,419	1,318
Relative yields	*100*	*126·8*	*128·3*	*151·4*	*118·3*	*105·8*	*114·7*	*111·3*	*103·8*
Production from 4th Feb. to 12th May, 1930	1,152	1,565	1,609	1,841	1,673	1,410	1,318	1,692	1,359
Relative yields	*100*	*135·8*	*139·7*	*159·8*	*145·2*	*122·4*	*114·4*	*146·9*	*118·0*
Production from 30th Jan. to 11th May, 1931	4,133	5,992	5,974	6,740	6,719	5,489	5,356	5,593	5,320
Relative yields	*100*	*144·9*	*144·5*	*163·0*	*162·5*	*132·8*	*129·6*	*135·3*	*128·7*

(12) Effect of Treatments on Production during Winter and Early Spring Period from about middle of May to middle or end of August, approximately.

Winter and early spring production is limited more by temperature than by available moisture. Although September is often a difficult month from the farmers' point of view, it is because this month is a critical one for breeding-stock, which are then in their early lactation period, and the provision of ample good feed at this stage has an important bearing on subsequent production of lactating animals. September production at Marton has proved decidedly better than that during the preceding three or four months, and, although September has not proved a month of plentiful growth, it does not fall into the really low-production period, and is therefore omitted from the period under discussion. Table 7 gives results for this phase of the experiment.

Comments on Table 7.

The effect of all super applications on winter and early spring production is markedly superior to the effect from corresponding slag applications.

The autumn application of super has proved most effective in each of the three seasons, although its superiority over some of the other applications of super is considerable only in the 1930 season. Of the slag applications the autumn one has proved better than the others in the two latter seasons, the winter application being the best in 1929.

Table 7.—Showing Production in Pounds per Acre of Freshly-cut Herbage, and Relative Yields from Different Treatments (no Manure = 100) for the "Winter and Early Spring" Period.

Period.	Yields in Pounds per Acre of Green Herbage and Relative Yields (the latter in Italics). (No Manure = 100.)								
	No Manure.	Superphosphate applied.				Slag applied.			
		Winter.	Spring.	Summer.	Autumn.	Winter.	Spring.	Summer.	Autumn.
Production from 22nd May to 5th Sept., 1929	1,315	2,418	2,171	2,400	2,481	2,040	1,849	1,836	1,836
Relative yields	*100*	*183·8*	*165·1*	*185·6*	*188·7*	*155·1*	*140·6*	*139·6*	*139·6*
Production from 12th May to 28th Aug., 1930	993	1,988	1,962	2,262	2,658	1,647	1,460	1,359	1,813
Relative yields	*100*	*200·2*	*197·5*	*227·8*	*267·6*	*165·8*	*147·0*	*136·8*	*182·6*
Production from 11th May to 14th Aug., 1931	1,325	1,892	2,162	2,148	2,254	1,798	1,756	1,915	1,967
Relative yields	*100*	*142·7*	*163·1*	*162·1*	*170·1*	*135·7*	*132·5*	*144·5*	*148·4*

(13) Rapidity of Effect from Manure Applications.

With one or two exceptions, the effect of manure dressings has been markedly evident in the first cut taken after application of the manure. The time between applying the manure and the first cut subsequently varied from eight days to six or seven weeks, according to the season of the year. The super effect was consistently more rapid than that from slag.

(14) Effects of Manures Relative to No Manure under Different Conditions of Growth.

The manures, especially super, gave their greatest percentage increases during low-production periods. The effect of this is brought out in Table 4, where it is shown that a greater percentage of the production for the year occurs during the low period in the case of manured plots than where no manure was used. The summer and autumn applications of super are definitely superior in this respect to other super treatments and to all slag treatments. Even during those times of poorer growth which fell in the high-production periods the relative effect of the manures was greater than when conditions were conducive to good growth. Herein lies a very valuable aspect of phosphatic manuring.

(15) Production of Dry Matter.

The amount of dry matter in herbage was determined for all growth which occurred between 24th February, 1930, and 14th August, 1931. The scope of this article does not allow of a detailed discussion on the production of dry matter. The relative results expressed as green herbage are not materially altered when considered in terms of dry-matter production.

During periods of high production (rapid growth) the herbage usually contained less dry matter than during periods of low production (slow growth), and the herbage from no-manure plots tended to have a slightly higher dry-matter content than that from manured plots during high-production periods. The dry-matter content of all treatments was much the same during the low-production period. The production of dry matter for the period mentioned (about eighteen months) was about 19·2, 18·8, and 18·9 per cent. of the green weight for no manure, the average of all super treatments, and the average of all slag treatments respectively.

Summary and Conclusions.

(1) A trial in which the production from a pasture has been measured throughout a period of three years, conducted at the Marton Experimental Area, is described. Measurement of production has been carried out by weighing the herbage cut with a lawn-mower from forty-five successive growth periods. By having triplicate areas from which cuts have been taken in turn, it has been possible to introduce stock so as to maintain the pasture under conditions comparable to intensive rotational grazing.

(2) No manure, and winter, spring, summer, and autumn applications of superphosphate and basic slag respectively, at 3 cwt. per acre per annum, were the treatments under trial. Each treatment was replicated frequently, and evidence of a high degree of accuracy in the measurement of relative yields resulted. The pasture is considered a comparatively poor one botanically, but representative of a good proportion of pasture in the district.

(3) On account of a weakness in the technique applied in the first two years, it is certain that actual production was underestimated, especially in the low-production periods. It is considered that the relative results are reasonably accurate, however, and a modification of the technique in the third season is considered to have given a much better measure of actual production.

(4) The total production as measured (see para. 3 above) on no-manure plots for the three years was 54,476 lb. of green herbage per acre. On the basis of dry-matter determinations made over the last eighteen months of the trial, this equalled approximately 10,500 lb. of dry matter or 3,500 lb. per acre per annum. The best of the manured plots yielded about 50 per cent. more than this, or about 5,250 lb. of dry matter per acre per annum.

(5) Superphosphate proved decidedly superior to basic slag, irrespective of the time of the year at which applications were made.

(6) Of the super applications, those made in summer and autumn have tended to give higher yields over the year as a whole than winter and spring applications.

(7) An important aspect of the summer and autumn dressings is that they have given a greater percentage of their production during low-production parts of the year than any of the other manure treatments. All manure treatments have given a greater percentage of their production during low-production periods than no manure.

(8) During the period in which pastures are normally closed for silage and hay crops the spring application of super has had the greatest effect on yield.

(9) During the late summer and autumn period the summer application of super has yielded best.

(10) During the winter and early spring the autumn application of super has yielded best.

(11) During the last eighteen months of the trial the percentage of dry matter in the herbage was determined. Expressing yields as those of green herbage did not materially affect the relationship between manured plots and no manure when compared with expressing them as dry matter.

(12) Under conditions such as those at Marton it is obvious that not only does superphosphate produce markedly better than slag, but it also lends itself better to manipulation of applications so as to increase production relatively more in low-production periods than in high ones, thus tending towards a more uniform production throughout the year.

(13) Up to the time of writing there is no indication that slag is tending to approach more closely to superphosphate in production.

I regret having overlooked acknowledging in the previous article my indebtedness to Mr. J. W. Deem, Director of the Fields Division, for placing land and the services of his officers, Messrs. Wards and Lonsdale, at my disposal in connection with this work.

CONTROL OF THE RABBIT PEST.

REFERENCE to this subject is made in the annual report of the Director of the Live-stock Division for 1930–31, as follows :—

The control of rabbits during the year has given some concern, and although good work has been done in many districts there are no doubt some localities where the incidence of rabbits is less satisfactory than in recent years. This position is due to the seasonal conditions enabling rabbits to breed up quickly during the spring and summer months, together with low prices for furs and the financial depression which placed many settlers in the position of being less able to pay for the usual suppression methods. For several years prior to this one the high price of skins induced a considerable number of experienced rabbiters to engage in the work of rabbit-destruction with little or no cost to the landowner, but early in the present season the value of furs receded to a point where the collection of skins ceased to be a payable occupation. Rabbit-control work at once became a direct charge on the landowner at a time when very few of them were in a position to employ extra labour. The altered conditions necessitated closer attention to rabbit inspection, with the result that a good deal of work has been carried out in most districts. Strychnine poisoning is still giving excellent results, and, although a little more costly than poisoning with phosphorized pollard, is nevertheless in favour as a reliable destructive agent. On account of the increase in the pest, a heavy demand set in for phosphorized-pollard poison, approximately 20 tons being despatched from the Frankton Poison-mixing Depot in two months. Rabbit Boards have, without exception, carried out their work in a satisfactory way, and rabbits in their areas are well under control. Under localized Board control the work goes on systematically throughout the year, and the conditions in the various areas under their jurisdiction are striking evidence of what can be done by systematic operations and continuity of effort.

SILVER-LEAF DISEASE IN THE ORCHARD.

G. H. CUNNINGHAM, Mycologist, Plant Research Station, Palmerston North.

As numerous recent requests have been made by orchardists for further investigation of silver-leaf, it is evident that this disease has proved a serious problem to growers during the past two or three seasons.

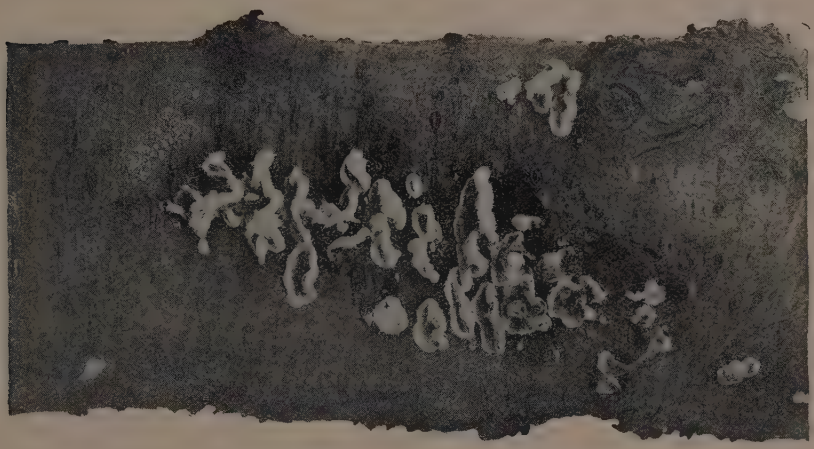
In "Fungous Diseases of Fruit-trees," page 284, I reviewed available knowledge concerning this disease, and showed that it is caused by a fungus which penetrates trees through injuries, such as saw-cuts, branch rubs, split branches, and the like, and that control measures consisted of coating these injured surfaces, as soon as they were formed, with some such protective covering as coal-tar. It was shown that the fungus was able to infect pome and stone fruits, and in addition such plants as poplar, willow, broom, and silver-birch, upon which it produces the spore-producing bodies or fructifications. Spores produced from such bodies on alighting upon an injured surface may germinate and cause infection of susceptible trees. The mycelium of the fungus may then penetrate into the healthy tissues, and gradually extend until finally the whole tree is killed. As it develops, the fungus produces a substance which, carried in the sap to the leaves, produces the silvered condition so characteristic of the disease.

From this brief summary of the life-history of the fungus it is obvious that control of silver-leaf can be effected in one of two ways: (1) By eliminating the sources of infection; (2) by protecting tree-wounds in such a manner that parasitic fungi cannot gain entry.

When it is realized that broom, which is very susceptible to attacks of this fungus and upon which fructifications are produced very readily, may be found by the hundred acres in the vicinity of most fruit districts, it is evident that eradication of the sources of infection is quite impracticable. And this is made even more apparent by the fact that willows, poplars, tagasaste, and several species of *Acacia*, frequently used as shelter-belts round orchards, are also readily infected and in consequence may become active agents in spreading the disease. As the fungus seldom fructifies upon infected fruit-trees unless these have been killed outright, and as there are so many other sources of infection, it is evident that little would be gained by attempting to enforce destruction of infected fruit-trees. Consequently, this line of attack must be abandoned.

The alternative method of control is to cover wounds, as soon as made, with some protective covering. Where such treatment has been rigorously applied silver-leaf has proved of little moment, which shows that where the disease has recently become troublesome either growers have not followed instructions or conditions for the spread of the disease have been abnormal. A recent survey of certain orchards in which the disease has proved a serious problem has tended to show that in the majority of cases the owners have not carried out the recommended treatment, as almost invariably infected branches and trees could be traced to neglected or overlooked wounds. In perhaps 99 per cent. of cases where

wounds have been painted over with coal-tar no infection has resulted; but one or two cases have been observed where infection appears to have developed through injuries so treated. This would imply either that coal-tar is not an efficient protective cover (which is not supported by field evidence) or that some little time had elapsed between the period of removal of the branch and application of the tar.



FRUCTIFICATIONS OF THE SILVER-LEAF FUNGUS ON A PEACH BRANCH. ABOUT ONE-THIRD NATURAL SIZE.

[*Photo by E. Bruce Levy.*

Although we have been using it successfully in New Zealand for many years, the experiences of Brooks and Moore (1926, p. 72) and Brooks and Brenchley (1931, p. 1) have been that coal-tar is a poor protective against this disease under English conditions. In consequence, they recommend the use of "home-made white-lead paint" prepared as follows: To 2 lb. white-lead paste (as bought) add 2 teaspoonsful of paste driers and 2 tablespoonsful of linseed-oil; stir and add 2 tablespoonsful of turpentine, and mix thoroughly; apply with a brush in the usual way. As under our conditions coal-tar has given very successful results, it is probable that the material we have been using is a different substance from that tested by Brooks and his collaborators. Nevertheless, as occasional trees appear to have become infected despite this treatment, it would pay growers in those localities in which silver-leaf is a serious problem to use the white-lead paint.

One point of significance brought out by Brooks and Moore (1926, p. 69) is that freshly formed wounds are most readily infected, whereas cuts made some months previously are not susceptible to attack; and that infection is most likely to occur during the winter months. This illustrates the necessity for immediate application of the covering, following the formation of a tree wound.

It is a common experience throughout the Dominion that infected trees not infrequently recover from silver-leaf. This experience is not confined to New Zealand, since Brooks and his collaborators recorded numerous cases of recovery. One of these in particular, Brooks and Moore (1926, p. 80) is interesting, being a case at East Malling, where of 77 plum-trees infected in 1922, 56 had recovered by 1925. Brooks and Moore (1926) and Brooks and Brenchley (1931) have shown that recovery is due to the tree forming wound-gum round the invading fungus in such a manner as to prevent its advance, thus protecting the tree from further attack and ultimately killing the fungus. Swarbrick (1926) found that wound-gum was produced in branches following injury in such a way that wood vessels were blocked in the vicinity of the cut, thus preventing the entry of parasitic fungi, as they are unable to pass this barrier. This gum is produced most copiously in young branches or by vigorously growing trees and during a time corresponding with our November–February, whereas it is produced scantily in old branches or weakly trees, and scarcely if at all between times corresponding with our May–October. As it is evident that wound-gum is produced most copiously during the early summer, Swarbrick recommended that pruning be carried out at this time, since then trees would be least susceptible to infection by silver-leaf.

Consequently it would be well worth modifying orchard practice so that stone-fruit trees were pruned as soon as the fruits were picked. This would have the advantage of increasing the vigour of the tree, thus leading to an increase in the amount of wound-gum produced; of producing wounds at a time when gum was being formed in abundance, thus increasing resistance to penetration; and of enabling the operator to detect and remove all limbs showing signs of the disease. It may be said that if removal of branches showing signs of silver-leaf is practised during the summer there is a greater probability of the tree recovering than if cutting is carried out at any other season.

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Soils of Mohaka District.—The annual report for 1930–31 of the Chemistry Section, Department of Agriculture, states that a rapid survey of the soils of the Mohaka district (Hawke's Bay) was undertaken and a report furnished to the Progress Association there on the results of analyses. The soils were varied, comprising fine subaerial pumice on the gentler slopes, papa or mudstone on the steeper slopes where the pumice covering had been removed by erosion, and river-terraces of resorted material. The pumice soils varied from sandy silts to sandy loams, being on the whole finer than those of the Rotorua district, and therefore less likely to give rise to deficiency diseases. Iron was found to be low in the pastures, the immunity of ruminants to iron starvation (bush sickness) up to the present being probably due to the natural change of pasture provided by the papa and river-terrace soils.

COMMERCIAL FERTILIZERS AND THEIR BASIS OF SALE.

J. A. BRUCE, Inspector of Fertilizers, Department of Agriculture, Wellington.

III. ROCK PHOSPHATES AND PHOSPHATIC GUANOS.

ROCK phosphate occurs as an impure, insoluble phosphate of lime in many parts of the earth's surface. The impurities chiefly associated with it are calcium fluoride,* iron oxide, alumina, and siliceous matter.

The greater bulk of the phosphate mined is required for fertilizer use, principally for conversion into superphosphate. It is probably safe to assume that 75 per cent. of the total amount of all phosphatic types of fertilizers used in agriculture is obtained directly or indirectly from phosphate rock. A small proportion, possibly 5 to 10 per cent., of the world's total output is employed in the making of steel and for the preparation of phosphorus chemicals, baking-powder, &c.; and now that stock-licks and poultry-foods are claiming more attention on the markets, an increasing though still comparatively small amount of this important mineral is being used as an ingredient of such feeding-products.

Rock phosphates may occur in nature in the shape of soft phosphate, pebble or gravel phosphate, boulder phosphate, and as hard rock phosphate. In the largest fields the phosphate is in the form of sediments interbedded with other rocks such as limestone, sandstone, or shales. The extensive fields of Northern Africa, Western America, and Russia are of this type.

The exceptionally rich deposits of uniform-quality phosphate on Nauru, Ocean, and some other islands in the Pacific Ocean are of an entirely different nature, and how they came into existence is a matter for surmise. Some authorities hold the view that they are the result of the gradual reaction with coral limestone of guano deposited in enormous quantity by countless millions of sea-birds in ages long gone by. It is thought that the soluble phosphate of the guano has interacted with the limestone of the underlying coral formations in such a way as to form tricalcium phosphate of lime. The phosphates so formed as mined to-day are in some parts quite hard, and are more mineral than animal in character, since they contain practically none of the nitrogenous matter present in the original guano. Some authorities describe them as phosphatic guanos, but more often than not they are referred to as rock phosphates or mineral phosphates.

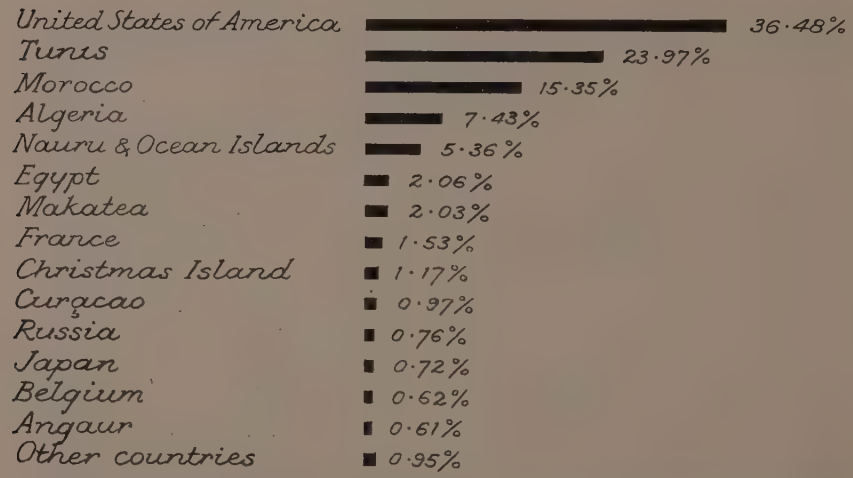
Several of the powdery forms of phosphatic guanos—for example, Seychelles guano, from the Indian Ocean—with a very low nitrogenous plant-food content (usually under 1 per cent.) have been sold under the designations of "guano" or "alluvial guano" for many years, but it should be noted that owing to their deficiency of nitrogen the description "phosphatic guano" is more acceptable from the purchaser's point of view.

* According to an American idea, based on X-ray investigation, the phosphorus of rock phosphate is now considered to be in combination with fluorine as a complex compound having the empirical formula $3Ca_3(PO_4)_2CaF_2$, with physical and chemical properties entirely different from those of tricalcium phosphate, the empirical formula of which is $Ca_3(PO_4)_2$.

Production and Consumption of Mineral Phosphates.

The greatest production of phosphate rock undoubtedly takes place in the United States of America and in North Africa. In these two countries the deposits are so enormous that there does not seem to be any immediate danger of their exhaustion. Important beds in Tennessee and Florida have great reserves of phosphate rock ranging in quality from 30 to 36 per cent. of phosphoric acid.

France, mainly in her North African colonies and protectorates, has, during quite recent years, produced about 50 per cent. of the world's total output. The United States, the largest single producer, in the year 1929 accounted for over a third of the total. The British Empire produced in the same year some 6 or 7 per cent. Of the other



GRAPH SHOWING PROPORTIONS OF WORLD OUTPUT OF RAW PHOSPHATES IN YEAR 1929—APPROXIMATELY 10,289,000 TONS—PRODUCED BY DIFFERENT COUNTRIES.

(Based on data in "Phosphates and Superphosphates" by A. N. Gray.)

nations it is interesting to note that no one of them produces more than 2 per cent. of the world's total, which latter is computed to have been approximately 10,289,000 tons in the year 1929.

European countries are easily the heaviest consumers of raw mineral phosphate; France, Germany, and Italy are the foremost, accounting for about 16, 8, and 6 per cent. respectively of the world's supply in 1928. The United States leads as an individual consumer, with nearly 28 per cent. in 1928.

The world-wide economic depression has naturally been responsible for a considerable reduction of output in some of the largest mines. The consumption of phosphates, too, during the past year has been adversely affected.

As previously mentioned, the greater proportion of raw phosphate is finely ground and manufactured into superphosphate; but it may

be of interest to consumers to know that the amount estimated to have been employed for direct application to the land in the year 1928 is 400,000 tons (basis, 28·5 per cent. phosphoric acid) out of a total of, roughly speaking, 21,500,000 tons of the principal commercial phosphatic fertilizers used by the world's agriculture. (A. N. Gray.)

Russia may be instanced as having immense deposits of phosphate rock awaiting exploitation. From all accounts there has been great activity recently in the search for new deposits, resulting in the discovery of large fields in the vicinity of Saratov, which is adjacent to the large agricultural region of the Volga. The Five-year Plan, it is reported, requires the production of an enormous quantity of phosphate rock and superphosphate. In the past the use of fertilizers in Russia has been much neglected.

Development of the Use of Raw Phosphates as Fertilizers.

Phosphatic guanos, as we know them on the local markets, are usually of a soft nature. For a long period they have been applied to the soil without treatment other than drying and screening. On the other hand, the use of dry, finely ground, but otherwise untreated rock phosphate in the form of a grey powder for direct application in agriculture is comparatively speaking a modern development.

During the Great War sulphuric acid was needed in large quantities for military purposes, so that the superphosphate industry was placed on somewhat short supplies, and the price of superphosphate was raised considerably in consequence. Attention was then diverted to the employment of the more cheaply produced raw phosphates direct. Encouraging results were obtained from a number of field tests, so the practice became recognized as one offering scope for much investigation.

Changes to the "open hearth" method of steel manufacture in comparatively recent times, resulting in the more desirable basic slag produced by the Bessemer process becoming rather more difficult to obtain, gave a favourable opportunity to advocate the use of finely ground raw phosphate in preference to basic slag. Several agronomists and agricultural chemists in Europe have strongly supported the practice of fertilizing soils poorly supplied with phosphate with the finely ground natural phosphates—more particularly those from North Africa. Of the British advocates two names stand out prominently—Professor Hendrick of Aberdeen and Dr. G. S. Robertson. Both these authorities based their pleas for extending the use of raw phosphates on the results of field experiments conducted under varying conditions of soil and climate in different parts of the British Isles. Within the past few years the practice of applying easily crushed phosphates from Tunisia, Morocco, Algeria, and Egypt to grazing-land has grown considerably.

Although the amount of raw phosphate used for direct application to soils is increasing, the quantity sold for such purpose is still very small when compared with the enormous quantities of phosphate rock manufactured into superphosphate. The evidence at hand is to the effect that very little rock phosphate is sold for use on dry open-textured soils in any country. For instance, in the drier districts of New Zealand, such as Hawke's Bay and Canterbury, practically no

phosphate is offered for sale in the undissolved state. On the other hand, in the higher rainfall areas of Auckland Province large quantities of North African phosphates have been sold for top-dressing grasslands. Seychelles phosphatic guano is also popular in Auckland, as well as in the wetter portions of Southland and Otago. Experience has shown, in fact, that for use on sour, peaty and swampy soils the raw phosphates, having alkaline properties and being at the same time more slowly available, often offer distinct advantages over soluble types of phosphatic fertilizers.

It is outside the scope of this article to discuss the subject of whether or not it is economically sound to use finely ground phosphate in preference to chemically treated phosphates. In any case the available evidence is contradictory and controversial. Considerable difference of opinion even exists as to the efficiency of the basic raw phosphates under wet climatic conditions in this country.

The Dominion's Phosphate Supplies and their Sources.

It is now proposed to discuss briefly the phosphates that are delivered to the Dominion from a variety of sources.

It may be of interest to mention in passing that a small deposit of rock phosphate located near Clarendon, Milton, Otago, was first worked in the year 1902, but the output was never great. Production ceased in 1924, when 1,570 tons were taken out. The higher-grade material of the deposit contained about 28 to 30 per cent. of insoluble phosphoric acid (61 to 65·5 per cent. phosphate of lime). It is roughly estimated that between 1905 and 1924 125,000 tons were mined.

NATURAL PHOSPHATES FROM THE PACIFIC.

Nauru and Ocean Islands.—The two small coral islands of Nauru and Ocean, with areas of approximately twelve square miles and four square miles respectively, situated some 160 miles apart from each other near the Equator, furnish Australia and New Zealand with the very best raw phosphate obtainable for superphosphate manufacture. Deliveries received from both islands for conversion into superphosphate consistently yield 36·5 per cent. or more of phosphoric acid (equivalent to 80 or more per cent. tricalcium phosphate of lime). Notwithstanding the fact that the phosphate of these two islands is the highest grade in the world, only a comparatively small proportion is used for incorporating in proprietary mixed fertilizers or is sold for use direct in a finely ground condition.

Ocean Island phosphate is a trifle higher in fertilizing strength than the Nauru article, but no discrimination is made when selling to users, as they are both so similar as regards quality. Under the Fertilizers Act Nauru-Ocean phosphate is sold with a guarantee of 36·5 per cent. of insoluble phosphoric acid. A further stipulation that 80 per cent. of the material will pass through the standard 100-mesh sieve (10,000 holes to the square inch) is supplied on the invoice certificate.

The phosphate deposits of Nauru and Ocean Islands are owned conjointly by Great Britain, Australia, and New Zealand, the production and distribution being undertaken by the British Phosphate Commission, on which each partner is represented. Several articles

Table 1.—Importation of Raw Phosphates into New Zealand during Period 1920–1931.

Nature of Raw Phosphate.	Origin.	Quantity in Tons.	Percentage of Total Imports from all Sources.
	Pacific Ocean.		
Rock phosphate ..	Nauru Island ..	641,642	
	Ocean Island	321,107	
	Makatea Island ..	159,043	
Total	..	1,121,792	74·2
Phosphatic guano ..	New Caledonia ..	60,368	
	Walpole Island ..	14,030	
	Malden Island ..	3,660	
	Surprise Island ..	3,381	
Total	.. ..	81,439	5·4
Total for Pacific	..	1,203,231	79·6
	North Africa.		
Mineral rock phosphate ..	Morocco	78,948	
	Tunisia	68,633*	
	Egypt	54,955	
Total	..	202,536	13·4
	Indian Ocean.		
Phosphatic guano ..	Seychelles Archipelago	83,607	5·5
	United States of America.		
Mineral rock phosphate ..	Florida	21,977	1·5
Grand total of importations	..	1,511,351	..

* 60,812 tons presumably ground in Belgium and re-exported.

NOTES.—Ocean Island: No imports in 1921–22. Makatea Island: No imports in 1925-26. Walpole Island: Imports received only during four years, 1926–30. Surprise Island: Imports only during 1926–27. Malden Island: Imports only during 1922–23 and 1926–27. New Caledonia: No imports during last two years. Seychelles: No imports during 1920–22 and 1923–25. Morocco: No imports until 1927–28; regularly imported since. Tunisia: No imports until 1928–29; regularly imported since. Egypt: No imports during 1921–23 and 1930–31. Florida: Imports only during 1926–27.

on the history and various aspects of the enterprise have appeared in this *Journal*, notably in the issues for December, 1920, September, 1925, and December, 1930.

Reserves of phosphate on Nauru and Ocean Islands are conservatively estimated at 100,000,000 tons. During the ten-year period from 1920 to 1929 some 4,418,000 tons are estimated to have been shipped from both islands, so there is no likelihood of exhaustion of supplies for many decades to come.

Makatea is a small island belonging to France lying about 120 miles north-west of Tahiti. The high-grade material of this deposit analyses over 36 per cent. phosphoric acid (80 per cent. tricalcium phosphate), while the lower grade is reputed to yield 30–33 per cent.

phosphoric acid. Last year 20,401 tons were delivered to the Dominion for manufacture into superphosphate. It is estimated that some 10,000,000 tons of the higher-grade material (similar to Nauru-Ocean phosphate) are available for future demands, exclusive of a large quantity of lower-grade rock. The total exports of phosphate from the island in 1930 were 242,900 tons.

Walpole Island Phosphatic Guano.—Walpole Island is a dependency of New Caledonia, and is therefore under French administration. The soft, earthy, or alluvial phospho-guano from this source is usually of a chocolate-brown colour, and is registered under the Fertilizers Act to contain 19·8 per cent. of insoluble phosphoric acid. In addition to being soft and friable, and therefore more readily available than some of the harder phosphates, an appreciably high carbonate of lime content seemed to enhance its popularity some years ago for direct application to crops and as a conditioner for proprietary fertilizer mixtures. Last year importations of the material ceased, but small stocks remaining over from the 5,500 odd tons imported in 1929–30 are still held in the Dominion.

Malden Island phosphatic guano (20·6 per cent. insoluble phosphoric acid) and *Surprise Island* phosphatic guano (12–14 per cent. insoluble phosphoric acid) have not been imported for several years, and therefore need not be described.

THE PHOSPHATES OF NORTH AFRICA.

As most of the raw mineral phosphates sold in the Dominion for top-dressing purposes are from North Africa it is appropriate that they should be discussed a little more fully than the Pacific phosphates, which are chiefly used for superphosphate manufacture. Furthermore, judging by questions frequently asked in regard to their production and particular districts of origin, a little general information will not be out of place here.

Apart from the Florida field in the United States, the three largest phosphate-producing fields in the world are in the French colonies of Tunisia, Morocco, and Algeria respectively—production from these three countries alone representing nearly half of the world's total. No doubt the possession of these vast deposits favourably situated close to European markets have contributed to the agricultural prosperity of France, as she is able to secure price concessions and cheap freights on the very large tonnages sold within her territories. Even as far as our Dominion is concerned shipping freights on North African phosphates are surprisingly low, and this to some extent explains the reason for the products being retailed at very low cost per unit of phosphoric acid.

The reserves of phosphates in the North African fields are roughly estimated by one American authority (G. R. Mansfield) to be in the vicinity of 4,000,000,000 tons, or nearly a quarter of the estimated known reserves of the world, which have been guessed as being somewhere about 17,000,000,000 tons.

North African phosphate rock, especially of the Tunisian type, is soft and easily ground to powder. For this reason it seems to have gained more popularity than other classes of phosphate rock for use in the raw state. By far the largest quantity of North African phosphate rock, however, is made into superphosphate. In general character and

grade the phosphates of Tunisia, Algeria, and Egypt are broadly classed by several authorities as being similar. The Moroccan product is of higher grade, and is perhaps more adaptable for superphosphate manufacture than the phosphate from the other three countries mentioned.

Another interesting feature concerning the marketed North African phosphates is that they often have a certain amount of free lime carbonate in their composition. Nevertheless the small amounts present, while very beneficial, cannot be expected to take the place of adequate dressings of slaked lime or ground limestone indispensable for some soils.

Tunisian Phosphate.—The deposits of Tunisia were originally discovered in the year 1873, but were not opened up until 1893. The most important deposits are situated near Gafsa, close to the Algerian border, and in that locality the mines are linked up some 150 miles or more by rail with the ports of Sfax and Sousse. The largest producing mine in the world is at Gafsa. The whole of the country in 1929 produced nearly 2,500,000 tons, but under the present uncertain marketing conditions production throughout the whole mining area has suffered severe curtailment. Mining operations are apparently conducted in some cases by tunnelling into the phosphate strata and digging the rock out somewhat after the methods adopted in coal-mining.

In quality the rock mined ranges between 26 and 32 per cent. of insoluble phosphoric acid or 58–70 per cent. tricalcium phosphate (see Table 2, page 335, for grades registered for sale locally). The carbonate of lime may go as high as 14 per cent., but it is not yet officially recognized as having commercial value. Following is the composition of Tunisian phosphate compared with Nauru phosphate :—

	Tunisian Phosphate* (Per Cent.).	Nauru Phosphate† (Per Cent.).
Tricalcium phosphate equivalent to ..	60 to 68	85·89
Phosphoric acid (P_2O_5)	27·5 to 31·2	39·34
Carbonate of lime	11·5 to 14·0	4·69
Oxide of iron and alumina	1·0 to 2·0	0·76
Calcium fluoride	6·6	..
Siliceous matter	6·0	..
Organic matter	..	2·86
Water‡	..	3·87

* According to Waggaman and Easterwood. † Parrish and Ogilvie. ‡ The usual moisture content of phosphate rock as sold is about 3 to 4 per cent.

Tunisian phosphate, such as from the Gafsa mines, is generally advertised according to a grade designation indicating the percentage range of tricalcium phosphate contents. The lowest grade, for instance, is described as a 58–63 per cent., another 63–68 per cent., and the highest grade as 65–70 per cent. The equivalent value of these claims of quality expressed in terms of insoluble phosphoric acid is given in Table 2. It may be mentioned that the constituents of Tunisian phosphate rock vary considerably at different points of production.

Despite the fact that under the Fertilizers Act a vendor may, if he chooses to do so, furnish a guarantee of citric solubility to purchasers, no one has so far taken advantage of this provision as regards raw phosphate. Many claims of 90-per-cent. solubility have been made in advertising-matter, and unit values even based on them, but as the Act does not cover any form of advertised statement no action can be taken respecting claims of this nature. Fertilizer terminology in the form it

appears in some advertisements would not find a place in an invoice certificate. It is obvious, then, that the invoice certificate should be the proper guide or reference when fertilizer is bought. Every effort should be made by the buyer to grasp the meaning of the statements of quality on the document.

What should be particularly noted at all times in reference to North African rock phosphates is that they are required to be sold in the same way as any other class of rock phosphates—that is to say, according to the insoluble phosphoric acid (plant food) content and fineness of grinding. (See Table 2.) Any reader wishing to ascertain the solubilities of Tunisian and Moroccan phosphates is referred to a table setting these out in the first article of this series on page 333 of the *Journal* for May, 1931.

Moroccan Phosphate.—The exploitation of the Moroccan deposits, although in the hands of a private company, is really a State monopoly, somewhat resembling the Nauru-Ocean phosphate undertaking administered by the British Phosphate Commission.

From a very modest beginning the phosphate industry has grown phenomenally in a short space of time. The first shipments of 8,085 tons in 1921 rapidly rose year by year to 1,579,286 tons in 1929. The main beds, reputed to consist of grey fragile rock, are worked some sixty miles or more south-east of the port of Casablanca on the Atlantic coast. The extracted rock is sifted and dried at Kourigha, a recently developed industrial centre close to the mines. Following this, it is transported by railway to Casablanca, whence it is shipped mainly to European ports.

For some years now Moroccan phosphate has been delivered to fertilizer works in New Zealand, where it is finely ground and either sold direct or in mixture with other fertilizers such as superphosphate. The guaranteed quality of the locally ground material is just over 33 per cent. of insoluble phosphoric acid (equivalent to 73 per cent. of tricalcium phosphate). Usually this class of fertilizer is advertised as a 73–78 grade, which, if expressed in terms of phosphoric acid, is equal to approximately 33–36 per cent.

Egyptian Phosphate.—The beds of phosphate in Egypt are fairly extensive. Apparently they have been worked only to a moderate degree in the Kosseir and Safaga districts, near the coast of the Red Sea, and at Sabaia, near Kenek, on the Nile. The Safaga mine, twenty miles inland from the port of Safaga, is worked by British capital, while the workings at Kosseir and Sibaia are controlled by an Italian company. The British concern operating at Safaga is responsible for the production of the well-known Ephos basic phosphate. In general character the Egyptian phosphate beds are classed as similar to those of Tunisia and Algeria, bearing at various points between 25 and 31 per cent. of phosphoric acid (equivalent to approximately 55–68 per cent. of tricalcium phosphate). Japan, a very keen buyer of phosphates, seems to be the chief customer for material from the Safaga area. Ephos is registered under the New Zealand Act to contain 25 per cent. of insoluble phosphoric acid, and carries a fineness guarantee of 80 per cent.

Algerian phosphate is not imported into New Zealand.

Table 2.—Particulars of Raw Phosphates registered for Sale in New Zealand, Year 1931–32.

Name.	Geographical Origin.	Number of Distinctive Brands used by Vendors.	Usual Advertised Grade Mark or Trade Term (representing Tricalcium Phosphate).	Usual Grade Figures in Terms of Insoluble Phosphoric Acid Plant-food (approx).	Insoluble Phospheric Acid Plant-food Content as registered (Average).	Registered Water-insoluble Phosphoric Acid Plant-food, expressed in Pounds per Ton (2,240 lb.).	Fineness of Grinding of Raw Phosphate.
			Range per Cent.	Range per Cent.	Per Cent.		Per cent.
Nauru-Ocean phosphate ..	Nauru and Ocean Islands	43	80–84	36–38	36·5	818	80
North African phosphate ..	Tunisia ..	7	58–63	26–29	26·5	594	80–90
		4	63–68	28–31	28·2	632	80–90
		9*	65–70	29–32	29·7	665	80–95
North African phosphate ..	Morocco	38	73–75	33–34	33·4	748	80
			73–78	33–36	34·0	762	80
Egyptian phosphate (Ephos basic phosphate)	Egypt	1	..	..	25·0	560	80
Others (Sulphurophosphate†) ..	Belgium	1	..	..	18·0	403	80
Walpole Island phosphatic guano	Walpole Island	12	..	..	19·8	444	..
Seychelles phosphatic guano ..	Juan de Nova, Assumption, and St. Pierre Islands ..	26	..	..	26·5	594	..

* Sold under such brands as "Camel," "Hyfos," "Phosfull," "Solfos," &c., applied by vendors selling locally.

† A specially prepared article containing sulphur as well as phosphate.

Table 3.—Particulars of Principal Proprietary Mixtures containing Raw Phosphates registered for Sale in New Zealand, 1931.

Name.	Geographical Origin of Raw Phosphate.	Number of Distinctive Brands.	Registered Analysis (Average).			Registered Plant-food expressed in Pounds per Ton.			Fineness of Grinding of Raw Phosphate.
			Phosphoric Acid.		Potash (K_2O) present as Chloride.	Phosphoric Acid.		Potash (K_2O).	
			Soluble in Water.	Insoluble in Water.		Soluble in Water.	Insoluble in Water.		
			Per Cent.	Per Cent.	Per Cent.				Per Cent.
Nauru-Ocean phosphate and superphosphate 44–46	Nauru and Ocean Islands	36	9·0	18·0	..	202	404	..	80
Moroccan phosphate and superphosphate 44–46	Morocco	33	9·0	17·5	..	202	393	..	80
Potassic phosphate	Morocco	3	..	27·5	5·0	..	616	112	80
Potassic Phosfull	Tunisia	2	..	23·0	5·0	..	515	112	80
Potassic Gafsa phosphate ..	Tunisia	1	..	18·0	8·0	..	403	179	80
Seychelles phosphatic gauno and superphosphate 44–46	Juan de Nova, Assumption, and St. Pierre Islands	14	8·0	15·0	..	179	336	..	80

Phosphatic Guanos from the Indian Ocean.

Seychelles Guano.—This is another form of loose, friable, readily available phosphatic guano containing a little nitrogenous matter. Supplies come in every year from the small islands of Juan de Nova, off the coast of Madagascar, and from St. Pierre and Assumption Islands, in the Seychelles Archipelago. As a general rule it is of a chocolate-brown colour. A little higher content of organic matter gives the material at times a more earthy smell and a darker colour. However, this does not detract from the value of its fertilizing strength. Frequently it is sold in the unbagged state in truck loads. One decided advantage of this type of phosphate is that it does not require to be finely ground, but merely dried and screened to remove hard lumps. In addition to a plant-food content of 25–27 per cent. of phosphoric acid, it contains some carbonate of lime to enhance its value for top-dressing purposes.

Christmas Island has an important deposit of high-grade phosphate, but none of the rock is at present shipped to the Dominion.

Possible Trend of Developments Associated with the Utilization of Phosphate Rock.

It will be readily realized that a better understanding of the nature and qualities of both manufactured and unmanufactured types of phosphates on the market will enable their judicious application to be extended. If, for example, the phosphatic needs of our pastures as a whole were anywhere near being satisfied it would severely tax the present capacity of all the fertilizer-works throughout the country to cope with the demand. Discoveries of phosphates capable of economic development may be made in the Dominion in the future, and no doubt they would be profitably utilized, as there is no country that can at present afford to ignore phosphate resources.

Great possibilities are ahead of the air-nitrogen fixation industry. Its influences on the ultimate utilization of both high and low grade phosphate rock may be considerable, Air-nitrogen factories may in the future in some cases be built in close association with concentrated phosphoric acid producing plants situated alongside phosphate mines. Under such conditions it would not be difficult to accomplish the manufacture of various concentrated combinations of phosphate and ammonia, which in turn could be combined with potassic compounds to make " complete " concentrated fertilizers. So that instead of transporting raw rock phosphates, manufactured preparations of three or four times the strength of ordinary fertilizers could be transported direct to the consumer and diluted to a lower grade on the farm if necessary.

(Series to be continued.)

Yorkshire Fog Improvement.—The Agrostologist, Plant Research Station, reporting on work during 1930–31, states that one thousand single plants and ninety-seven lines collected from all over New Zealand are under trial, and that there is sufficient evidence to warrant further investigation of this grass from a herbage-type point of view. A good deal of preliminary testing of growth-form, freedom from woolliness and dead bottom, palatability, rust-resistance, persistency, &c., is necessary.

OFFICIAL HERD-TESTING OF PUREBRED COWS.

SUMMARY OF THE SEASON'S WORK, 1930–31.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE final summing-up for the year ended 30th September, 1931, the fourth year of the Official Herd Test, indicates that 175 C.O.R. testing breeders availed themselves of this service, and that 2,236 cows were tested under the O.H.T. system. These are the highest figures yet reached, and represent an increase of no less than thirty breeders and 770 cows over the preceding year. Some of the increase can no doubt be interpreted to signify an advancing popularity of the system, but it is also probable that the general economic position compelled many breeders to choose the O.H.T. in preference to the considerably more expensive even if more complete Certificate-of-Record Test.

Most readers are probably aware that the O.H.T. is a ten months' test, the rules setting the maximum testing period at 305 days. An analysis of the past season's results does not reveal justification for any change in the classification adopted in previous years, and consequently the tables included in this summary are on the basis of all cows on test for six months (180 days) or more. The tables do not take into consideration cows other than registered purebreds, some forty-eight of which were tested by special arrangement. There were 177 registered purebreds, and three other cows which did not remain in test long enough to qualify for inclusion in the tables.

Table I shows, according to breed, the numbers of cows tested and average production. It will be noted that there are heavy increases

Table 1.—Official Herd-testing in Two Part Seasons on Basis of all Cows on Test for 180 Days or more.

Breed.	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days in Milk.	Milk.	Butterfat.
		Season 1929–30.			
				lb.	lb.
Jersey	95	643	278	5,883·6	316·48
Friesian	17*	399	280	8,063·1	277·81
Ayrshire	8	97	281	7,204·9	285·75
Milking Shorthorn ..	7	131	273	6,561·5	254·07
Red Poll	3	34	282	5,975·4	242·04
Totals ..	130	1,304	279	6,717·5	294·21
		Season 1930–31.			
Jersey	134	1,187	283	5,851·7	314·26
Friesian	27*	632	274	8,256·8	286·42
Ayrshire	3	42	273	6,765·0	266·45
Milking Shorthorn ..	5	128	257	5,789·5	231·09
Red Poll	1	19	268	5,168·2	206·14
Totals ..	170	2,008	278	6,617·4	298·17

* One Friesian breeder also testing Jerseys.

Table 2.—Average Production in Classes and Breeds for all O.H.T. Cows.

Class.	Season 1929–30.				Season 1930–31.			
	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.
			Jersey.					
			lb.	lb.			lb.	lb.
Two-year-old and under	246	282	5,105·9	276·92	488	282	5,111·8	275·65
Three-year-old	92	275	5,994·2	325·24	174	274	5,708·9	310·32
Four-year-old	89	270	6,209·7	337·00	159	286	6,434·7	350·37
Mature	216	280	6,587·9	349·34	366	287	6,652·6	351·92
			Friesian.					
Two-year-old and under	112	282	6,500·9	228·08	207	280	6,978·3	246·14
Three-year-old	70	280	8,196·6	279·53	106	269	8,196·8	287·79
Four-year-old	70	278	8,737·4	296·86	88	266	8,394·6	291·46
Mature	147	279	8,868·7	306·36	231	273	9,377·5	319·96
			Ayrshire.					
Two-year-old and under	18	286	6,508·2	263·69	2	263	5,246·4	223·16
Three-year-old	20	281	7,027·8	279·67	13	273	6,634·6	258·71
Four-year-old	15	265	6,367·1	256·32	8	264	6,949·0	272·09
Mature	44	284	7,856·1	307·56	19	277	6,936·6	273·92
			Milking Shorthorn.					
Two-year-old and under	33	282	5,165·9	205·79	42	258	4,560·2	184·80
Three-year-old	19	263	6,309·8	247·98	20	266	5,781·2	240·01
Four-year-old	25	278	7,224·7	285·69	11	256	6,922·9	274·86
Mature	54	268	7,195·9	271·08	55	253	6,504·5	254·44
			Red Poll.					
Two-year-old and under	10	289	5,483·0	231·35	5	275	4,452·1	198·17
Three-year-old	11	293	5,861·5	235·63	6	265	4,729·5	187·82
Four-year-old	2	272	4,610·7	202·23	5	271	6,019·3	224·81
Mature	11	267	6,785·1	265·41	3	261	5,820·7	225·01

under the Jerseys and Friesians, and a falling-off in the number of cows tested under the other breeds. It will also be noticed that average production has advanced by nearly 4 lb. of butterfat, a very satisfactory position considering there were appreciably more cows and that the season was by no means an ideal one. The increase is obviously due to the influence of the considerably improved position of the Friesians.

Table 2 classifies the results for the past two seasons under the more detailed headings of the classes within the breeds. This table is useful for the two principal breeds, but it is obvious that the figures for the other breeds may be unreliable on account of their sparse representation.

In addition to the accompanying tables, we have taken out for comparison purposes the average yield of all last year's O.H.T. cows which were on test for 100 days or more, which is the principal classification for Group and for Association Own-Sample herd-testing. Last season's herd-testing average was 241·05 lb. butterfat in 247 days. The O.H.T. result works out at 291·11 lb. butterfat in 272 days, while the C.O.R. average for 1930 was 474·02 lb.

TURNIP MANURING IN THE SOUTH ISLAND.

SUMMARY OF FIELDS DIVISION EXPERIMENTS, 1924–25 to 1930–31, AND RECOMMENDATIONS TO GROWERS.

A DETAILED report has been prepared on turnip-manuring experiments in the South Island conducted by the Fields Division, Department of Agriculture, during the past seven years, but cannot be published in full in the present issue of the *Journal*. In order, however, to make the more essential information available to growers in connection with the present season's work, the salient features and recommendations as summarized in the report are here presented.

SUMMARY AND CONCLUSIONS.

(1) The results of fifty-eight experiments in the South Island conducted in the seven seasons 1924–25 to 1930–31 inclusive are analysed, and the effects on yield and germination of various fertilizers discussed.

(2) Most of the trials were carried out on a co-operative basis on farms, and in all cases plots were frequently replicated, and results submitted to statistical examination.

(3) The effect of manures on field germination was carefully investigated.

(4) The average of thirty-one trials in which plots receiving 1 cwt. of superphosphate per acre (seed and manure in 14-in. rows) could be compared with plots receiving no manure, ground rock phosphate, or super plus carbonate of lime (equal parts), shows that the germination on the super plots was 34·5 per cent. less than on the other treatments mentioned.

(5) The average of twenty-four trials shows that super 1 cwt. reduced the germination to 42 per cent. less than that on the super 1 cwt. plus carbonate of lime 1 cwt. plots, when the seed and manure were sown in 14-in. rows. The average difference in yield was 3·4 tons per acre in favour of super plus lime. When the seed and manure were sown in 7-in. rows, super 1 cwt. reduced germination to 20 per cent. less than that of the super 1 cwt. plus lime 1 cwt. plots. The difference in yield was slight (0·7 tons).

(6) Super 2 cwt. reduced the germination to 52 per cent. less than the germination on the super 2 cwt. plus carbonate of lime 2 cwt. plots when seed and manure were sown in 14-in. rows. Super 2 cwt. plus carbonate of lime 2 cwt. gave on the average 4·6 tons per acre greater yield than the super 2 cwt. treatment (thirteen experiments). With seed and manure in 7-in. rows the reduced germination caused by super 2 cwt. was 29 per cent. below that of super 2 cwt. plus carbonate of lime 2 cwt. The difference in yield in favour of the latter was 2·5 tons per acre (six experiments).

(7) When 2 cwt. of the mixture of super and carbonate of lime (equal parts) was compared with 4 cwt. of the mixture, the average germination was the same, both when these treatments were compared in 14-in rows and in 7-in. rows. The average difference in yield in favour of the heavier quantity was 1·7 tons per acre, both when in 14-in. rows and in 7-in. rows.

(8) When super 2 cwt. is compared with super 1 cwt. plus Ephos 1 cwt. the reduction in germination caused by super 2 cwt. was 46 per cent. less than that from the mixed phosphates when in 14-in. rows, and 10 per cent. less in the 7-in. rows. The yield of the super plus Ephos was 3·2 tons per acre greater than super when in 14-in. rows and 1·6 tons per acre less than super when in 7-in. rows.

(9) The addition of 1 cwt. of lime to the super 1 cwt. plus Ephos 1 cwt. mixture resulted in an average germination very similar to that from super 2 cwt. plus lime 2 cwt. The super 1 cwt. plus Ephos 1 cwt. mixture gave 28 per cent. lower germination than when lime was added, and the yields were in favour of the mixture containing lime.

(10) A mixture of 2 cwt. super plus 1 cwt. lime did not reduce germination injury nor increase yield to the same extent as the mixture of 2 cwt. super plus 2 cwt. lime. Varying the time (from one week to mixing immediately before sowing) between mixing the super and lime and sowing caused comparatively little difference in germination and yield.

(11) Super plus carbonate of lime, commercial basic super, and a special basic super made by mixing 85 parts super with 15 parts freshly slaked lime, did not differ in germination effect. In the main the yields from super plus lime and the special basic super were superior to those from commercial basic super. More work on basic super in competition with super and lime is required before definite conclusions can be arrived at.

(12) Super at 1 cwt. per acre in 7-in. rows compared with super 1 cwt. per acre in 14-in. rows resulted in better germination and yield in the 7-in. rows in one experiment. Super 1 cwt. plus lime 1 cwt. sown in 7-in. rows gave slightly better results (0·8 tons per acre) than when sown in 14-in. rows.

(13) Different methods of applying superphosphate in order to reduce germination injury resulted as follows:—

(*a*) Applying part of the super between the rows, when 14-in. row sowing of seed was practised, by drilling the manure through all coulters gave good results. It is considered that in view of the benefits of using the super plus lime mixture, the risk attending the use of straight super with the seed is not justified.

(*b*) Predrilling (drilling in before seeding) super gave as good results at 1 cwt. per acre as applying it with the seed, and distinctly better results when 2 cwt. was used.

(*c*) Postdrilling (when plants 2 in. to 4 in. high) gave good results in one experiment on which it was tried. The postdrilling of 1 cwt. super caused the yield to be increased by 6 tons per acre, and the postdrilling of 2 cwt. super resulted in a further increase over that from 1 cwt. postdrilled by about 2½ tons per acre. This experiment was on land at Methven capable of responding to fairly heavy dressings of phosphate.

(14) Results obtained at Gore Experimental Area, Southland, are discussed with particular reference to the method of sowing a proportion of

super below the seed and part with the seed when sowing heavy quantities in ridges. Some of these experiments have already been reported on in the *Journal*, and others are appearing in the present issue.

(15) The effect of sulphate of ammonia and 30 per cent. potash salts on germination and yield is discussed. Particular emphasis is placed on the danger to germination of using sulphate of ammonia or potash salts in contact with the seed. Predrilling of sulphate of ammonia had little or no effect on germination, and the same should apply to potassic fertilizers, although their application in this way has not been tried.

(16) Experimental data on the use of nitrogen and potash is too limited to enable general conclusions to be drawn.

Recommendations to Growers.

(1) Use a mixture of superphosphate and carbonate of lime. The mixing may be done immediately before sowing, but mixing a week or more before using is recommended. The mixture should be left in a heap for two or three days, when it will usually set to some extent. A further mixing will break the set, which will not recur. The mixture may then be bagged, if desired.

(2) Use from 2 cwt. to 6 cwt. per acre of the mixture, according to the class of land. Broadly speaking, the lighter drier land does not warrant heavy application. Wet conditions such as occur in Southland justify the use of the heaviest quantities.

(3) Basic super made by mixing 85 parts of super with 15 parts of freshly slaked lime gives promise of being as effective as the super plus carbonate of lime mixture in reducing germination injury and increasing yield. An amount of 132 lb. of this basic super will supply the same quantity of phosphate as 1 cwt. of super or 2 cwt. of super plus carbonate of lime (equal parts).

(4) If the use of straight super cannot be avoided, sow not more than 1 cwt. per acre with the seed, using 7-in. rows for preference, or sowing seed in 14-in. and manure in 7-in. rows. Extra super can be applied profitably on land capable of responding to more than 1 cwt. by predrilling (before sowing seed), or as a postdrilling across the rows when the crop is 2 in. to 4 in. high. Where ridging is practised, and it is necessary to use super alone, the greater part or the whole of it should be sown, from the front box of the ridger, below the seed.

(5) Mixtures of super with slower-acting phosphates of the Ephos, Seychelles, and North African type give quite satisfactory results, especially if 1 cwt. of carbonate of lime for each 1 cwt. of super in the mixture is added.

BURR CLOVER AND HAWKE'S BAY RYE-GRASS SEED.

Some concern has been expressed that with the present wide demand for Hawke's Bay rye-grass there is danger of introducing burr clover (*Medicago maculata*) with the seed into clean districts, as this weed occurs extensively in Hawke's Bay. Commenting on this matter, the Seed Analyst, Plant Research Station, states that owing to the fact that hooked pods harvested with rye-grass do not shed readily the chances of hulled seed occurring in machine-dressed lines of rye-grass are very small, while the pods are, of course, easily dressed out. The Seed-testing Station records show that over a period of two years only a small percentage of the samples from Hawke's Bay have contained this impurity, and then only in very small quantity.

SEED CERTIFICATION.

SUMMARY OF OPERATIONS DURING SEASON 1930–31.

Reported by J. W. HADFIELD, Agronomist, and J. H. CLARIDGE, Assistant in Agronomy, Department of Agriculture.

A SUMMARY of operations in connection with seed certification undertaken during the 1930–31 season by officers of the Fields Division of the Department of Agriculture is here presented. The following seeds have been subject to certification during the past season :—

(1)	New Zealand perennial rye-grass ..	Certified Mother seed. Certified Permanent Pasture seed. Certified First Harvest seed.
(2)	New Zealand white clover ..	Certified Old Pasture.
(3)	New Zealand brown-top ..	Certified free from red-top.
(4)	Seed wheat	On a basis of varietal purity and freedom from disease.
(5)	Seed potatoes	On a basis of varietal purity, cropping-power, and freedom from disease.
(6)	Seed beans	On a basis of freedom from bean-wilt.

Perennial Rye-grass.

Despite a considerable increase in the volume of work during last season, there has not been sufficient certified seed to meet the local demand. It is, however, pleasing to report that a considerable amount of Mother seed has been distributed in the seed-producing districts of the South Island, and we may look forward to the production in the near future of sufficient seed to meet New Zealand requirements, and a reduction in price accompanied by an increased demand from overseas.

Tables 1, 2, and 3 summarize the position for 1930–31 as compared with that of the previous season.

Table 1.—Perennial Rye-grass Field Inspection Results, 1930–31.

(Figures in parentheses refer to season 1929–30; this applies to all tables where such figures occur.)

District.	Mother Areas.		Permanent Pasture Areas (Mother).*		Permanent Pasture Areas.		First Harvest Areas.		Total Areas.		Rejected Areas.	
	Number.	Acres.	Number.	Acres.	Number.	Acres.	Number.	Acres.	Number.	Acres.	Number.	Acres
Poverty Bay ..	20	234	115	1,366	4	39	4	28	143	1,667	35	298
			(20)	(235)					(20)	(235)	(30)	(406)
Hawke's Bay ..	70	832	157	1,890	23	198	28	261	278	3,181	49	460
			(153)	(2,148)					(153)	(2,148)	(15)	(173)
Manawatu ..	..	..	4	46	..	..	3	67	7	113	..	..
Marlborough ..	..	..	..	..	..	..	2	14	2	14	..	..
North Canterbury	..	..	..	..	..	..	13	213	13	213	1	3
Mid-Canterbury	..	..	..	..	..	..	3	29	3	29	2	10
South Canterbury	..	..	..	..	..	..	8	88	8	88	..	..
North Otago ..	..	..	..	..	..	..	1	7	1	7	..	..
Central Otago ..	..	..	..	..	1	34	..	..	1	34	..	..
							(2)	(64)	(2)	(64)		
Otago ..	..	..	..	..	..	..	13	345	13	345	1	13
Southland ..	..	..	..	..	..	..	5	64	5	64	..	..
Total ..	90	1,066	276	3,302	28	271	80	1,116	474	5,755	88	784
			(173)	(2,383)					(175)	(2,447)	(45)	(581)

* These "permanent pasture areas" are subject to reclassification as "Mother seed areas" provided the sample trial report indicates a sufficiently high standard.

Table 2.—Perennial Rye-grass Acreage Harvested and Sacks sealed in the Field, Season 1930–31.

District.	Mother Areas.		Permanent Pasture Areas (Mother.)*		Permanent Pasture Areas		First Harvest Acres.		Total Areas.	
	Acres.	Sacks.	Acres.	Sacks.	Acres.	Sacks.	Acres.	Sacks.	Acres.	Sacks.
Poverty Bay ..	225	404	1,267	2,062 (321)	39	87	20	66	1,551	2,619 (321)
Hawke's Bay ..	691	1,922	1,782	4,868 (5,727)	180	639	250	1,486	2,903	8,915 (5,727)
Manawatu ..	..	..	26	144	..	..	67	375	93	519
Marlborough ..	..	..	..	..	..	..	14	69	14	69
North Canterbury ..	..	..	..	..	..	..	213	1,205	213	1,205
South Canterbury ..	..	..	..	..	..	..	86	361	86	361
North Otago ..	..	..	..	..	..	..	7	89	7	89
Central Otago ..	..	..	..	..	34	128	.. (64)	.. (247)	34 (64)	128 (247)
Otago	..	..	..	..	..	..	325	1,268	325	1,268
Southland ..	..	..	..	..	..	..	64	414	64	414
Total ..	916	2,326	3,075	7,074 (6,048)	253	854	1,046 (64)	5,333 (247)	5,290	15,587 (6,295)

* See footnote to Table 1.

Table 3.—Perennial Rye-grass Machine-dressing Returns, Season 1930–31.

Class of Seed.	Into Machines.		Out of Machines.		Loss per Cent.	Yield per Acre, in Bushels.
	Sacks.	Bushels.	Sacks.	Bushels.		
Mother Seed—						
Poverty Bay .. .	264	1,916·6	161	1,232·6	35·7	7·9
Hawke's Bay	1,535	9,252·6	636	5,072·3	45·2	9·2
Total	1,799	11,169·2	797	6,304·9	43·6	9·0
Permanent Pasture (Mother) Seed—*						
Poverty Bay	912	6,302·85 (1,267)	450	3,504 (736)	44·4 (42·0)	6·3 (5·0)
Hawke's Bay	3,635	22,745 (30,405)	1,840	14,434·4 (15,754)	36·5 (48)	10·8 (8·7)
Manawatu	144	694·8	56	421·6	39·4	16·2
Total	4,691	29,742·7 (31,672)	2,346	18,360 (16,490)	38·3 (47·9)	9·6
Permanent Pasture Seed—						
Poverty Bay	98	700	55	454·3	35·2	10·7
Hawke's Bay	571	3,558·45	277	2,184·9	38·6	13·5
Central Otago ..	128	625·65	61	484·75	22·5	14·2
Total	797	4,884·1	393	3,123·95	36·3	13·2

Table 3—continued.

Class of Seed.	Into Machines.		Out of Machines.		Loss per Cent.	Yield per Acre, in Bushels.
	Sacks.	Bushels.	Sacks.	Bushels.		
First Harvest Seed—						
Poverty Bay	63	375·55	25	182·35	51·4	9·6
Hawke's Bay	1,418	8,525·35	751	5,849·1	31·6	24·5
Manawatu	375	1,981·15	134	1,036·95	47·7	15·5
Marlborough	69	531	54	376	29·2	26·8
North Canterbury ..	1,200	6,728·25	608	4,631·6	31·2	21·8
South Canterbury ..	361	2,000†	162	1,110·35	44·6	12·9
North Otago	89	483·55	55	380	21·3	54·3
Central Otago ..	..	..	..	..	..	..
			(81)	(562·25)		(8·8)
Otago	1,217	5,212†	441	2,893·5	44·5	9·2
Southland	414	2,182·55	244	1,733·95	20·7	27·1
Total	5,206	28,019·4	2,474	18,193·8	35·2	17·8
			(81)	(562·25)		(8·8)
Grand total ..	12,493	73,815·4	6,010	45,982·65 (17,052·25)	37·7	11·9

* See footnote to Table 1. † Approximately.

In the past a special class called First Harvest seed has consisted of the produce from areas sown with Mother seed but from which no sample trial has been available. It has been decided to simplify the position by including all such seed in the permanent-pasture class, but, to allow differentiation, the tags and insert slips will have stamped thereon the words "First Harvest seed." There will then remain the two main classes of Mother seed and Permanent Pasture seed, but in certain cases the latter seed may be specially marked as "First Harvest." A similar procedure will be adopted with other grass and clover seeds.

White Clover.

During last season white clover seed harvested from pastures five years old or over has been eligible for certification as "Old Pasture." Much of the seed has been derived from the dressings of rye-grass from old pastures, the rest being from areas closed up specifically for the production of white clover seed. These two sources are tabulated separately in Tables 4 and 5, and the totals in Table 6. The amount of certified white clover dressed out of rye-grass has increased from 8,000 lb. to 41,000 lb., but there has been a decrease from 60,700 lb. to 25,700 lb. in other seed.

The demand in the past has been for seed from old pastures, the assumption being that such seed would most likely represent a more permanent strain than that from young pastures. It has now been established that while some old pasture seed is of a very permanent leafy type, other pastures are old because conditions have been favourable for reseeding. There is in New Zealand a regional strain of great persistence and winter growth combined with abundant dense and leafy foliage. It is this strain which has no doubt been responsible for the overseas demand for New Zealand white clover. These

Table 4.—White Clover certified "Old Pasture" from Areas closed specifically for Harvesting of White Clover Seed, Season 1930–31.

District.	Areas.	Acreage.	Into Machine-dresser.	Machine-dressed Seed.		Percentage of Loss in Dressing.
				Quantity.	Yield per Acre.	
			lb.	lb.	lb.	
Poverty Bay ..	1	9	794	278	30·9	65·0
Hawke's Bay ..	1	10	2,139	1,004	100·4	53·2
Nelson	1	9	609	566	62·7	7·2
Marlborough ..	3	31	6,383	5,337	171·5	16·7
North Canterbury	14	229	19,899	16,344	71·4	17·7
Central Otago ..	1	23	2,634	2,239	97·3	15·0
Total ..	21	311 (664)	32,458 (89,691)	25,768 (60,747)	82·7 (91·5)	20·7 (32·4)

Table 5.—White Clover certified "Old Pasture" dressed out of Machine Dressings of Rye-grass Seed, Season 1930–31.

District.	Areas.	Into Machine-dresser.	Machine-dressed Seed.	Percentage of Loss in Dressing.
		lb.	lb.	
Poverty Bay	29	8,500 (approx.)	4,859	42·8
Hawke's Bay	111	70,625	36,511	48·3
Total	140	79,125	41,370 (8,268)	47·7

Table 6.—Total Yield of White Clover certified "Old Pasture," Season 1930–31.

District.	Number of Areas certified.	Quantity of Seed machine-dressed and certified.
		lb.
Poverty Bay	30	5,137
Hawke's Bay	112	37,515
Nelson	1	566
Marlborough	3	5,337
North Canterbury	14	16,344
Central Otago	1	2,239
Southland	1	104*
Total	162	67,242 = 30 tons. (79,610 = 35½ tons.)

* Dressed out of brown-top.

facts having been established, the Department has now decided to discontinue the "hit or miss" certification of old pasture, and substitute the certification of the regional strain, which, although representing only about 10 per cent. of the seed harvested, has been responsible for the popularity of New Zealand white clover abroad. Certification of this strain under the name of "N.Z. White Clover" is to commence in 1932, and certification of "Old Pasture" will be discontinued.

Brown-top.

The bulk of our brown-top seed in the past has been exported to the United States of America, and it was anticipated that the introduction by that country of a tariff duty of 40 cents per pound would result in the amount of seed harvested being reduced to a fraction of what had been harvested in previous seasons. It is therefore satisfactory to note that seed is still being exported to the United States, markets have been opened up elsewhere, and there has been actually a slight increase in the total quantity of seed certified. On the other hand, there has probably been a considerable reduction in the production of non-certified seed. In Tables 7 and 8 will be found comparative figures of seed certified for the two seasons.

Table 7.—Brown-top Certification, Season 1930–31.

District.	Passed.		Harvested.		Rejected.	
	Number of Areas.	Acreage.	Number of Areas.	Acreage.	Number of Areas.	Acreage
Mid-Canterbury ..	11	2,090	11	2,090	..	..
South Canterbury ..	25	5,509	22	4,409	..	..
Otago	70	9,533	44	6,280	..	..
Southland	77	7,769	55	5,734	4	106
Total ..	183 (154)	24,901 (22,000)	132	19,513	4 (24)	106

Table 8.—Brown-top Seed harvested and machine-dressed, Season 1930–31.

District.	Number of Sacks harvested.	Into Machine-dresser.		Machine-dressed Seed.		Percentage of Loss in Machine-dressing.
		Sacks.	Lb.	Sacks.	Lb.	
Mid-Canterbury	1,062	1,048	79,655	304	45,103 (nil)	43·3
South Canterbury	581	553	42,245	211	29,260 (1,113)	30·7
Otago	828	812	64,926	369	49,109 (?)	24·3 (35·0)
Southland ..	736	714	66,280	348	47,411 (?)	26·8 (37·0)
Totals ..	3,207	3,127	253,106	1,232	171,083 (170,071)	32·4 (?)

Seed Wheat.

Two important changes were introduced in connection with wheat certification during the season 1930–31. In the past certified seed wheat has been purchased by the Wheat Research Institute at a fixed premium above the value of milling-wheat. The seed has then been machine-dressed and sold to merchants. Last season samples of farmers' dressed seed which reached the required standard were distributed to merchants, who then dealt direct with the grower. This has not in any way affected the application for inspection, and the acreage inspected has actually risen from approximately 2,300 in 1929–30 to 3,300 in 1930–31.

The second change has been the introduction of a fixed standard of varietal purity—namely, 99·8 per cent.—and a similar standard in regard to freedom from loose and stinking smuts. This clause has resulted in heavy rejections in the field, so that the acreage passed is only half that of the previous season, and represents only 385 acres passed out of nearly 3,300 acres inspected.

Of the twenty-seven crops which passed field inspection, only seventeen were submitted for inspection of grain sample. Two of these crops (an area of 7 acres of Hunter's and one of 3 acres of Solid-straw Tuscan) were rejected on the grain-sample submitted. Thus fifteen crops were finally passed and the produce branded in the field.

In addition to the 4,060 bushels of wheat which were tagged and sealed in 1930–31, a further 1,772 sacks (approximately 5,900 bushels) of seed were branded in the paddock. No application was made to have this tagged and sealed, and presumably it was not machine-dressed.

Prices paid to farmers for field-dressed certified seed wheat ranged from 5s. 8d. to 6s. 6d. per bushel in the case of Hunter's, and 5s. 3d. to 6s. in the case of Solid-straw Tuscan.

Mr. H. B. Veitch, Government Grader, undertook on behalf of the Wheat Research Institute the work of inspecting grain, distributing

Table 9.—Seed-wheat Certification: Number of Areas and Acreage inspected and passed in the Field, Season 1930–31.

(Figures in parentheses are acreages inspected and passed in the 1929–30 season.)

Variety.	Number of Areas inspected.	Acreage inspected.		Number of Areas passed.	Acreage passed.	
Solid-straw Tuscan	76	2,178	(1,610)	9	129	(490)
Hunter's	44	894	(584)	8	139	(190)
Velvet	6	85	(25)	3	28	(5)
Dreadnought ..	2	13	(5)	2	13	(5)
Marquis	2	36	(20)	2	36	(20)
Garnet	2	24	(25)	1	12	(20)
Solid-straw Velvet ..	1	16	(5)	1	16	(5)
Yeoman	1	12	(1)	1	12	(1)
Purple-straw Tuscan	1	14	..	..	..	
Major	1	17	(2)	..	..	
Totals ..	136	3,289	(2,277)	27	385	(736)

Table 10.—Seed Wheat branded in the Paddock and Quantities of Seed Machine-dressed, Season 1930–31.

Variety.	Areas passed.	Acreage passed.	Number of Sacks Field-dressed.	Seed into Machine-dresser.		Seed out of Machine-dresser.		Percentage of Loss during Machine-dressing.
				Sacks.	Bushels.	Sacks.	Bushels.	
Solid-straw Tuscan	4	71	815	507	1,686·9	463	1,540·5	8·7
Hunter's ..	5	83	1,126	35	116·7	29	98·6	15·5
Velvet	1	15	132	132	441	115	380·7	13·7
Dreadnought ..	1	12	225	225	750	193	633·9	15·5
Marquis ..	1	30	407	230	766·7	196	650·9	15·2
Garnet	1	13	130	130	432·7	114	379·2	12·3
Solid-straw Velvet	1	16	126	66	218·45	50	165·55	24·3
Yeoman ..	1	12	206	70	230·9	64	211·55	8·4
Totals ..	15	252	3,167	1,395	4,643·35	1,224	4,060·90	12·6

Table 11.—Quantity of Certified Seed Wheat machine-dressed and sealed in 1930–31 Season, compared with 1929–30 Season.

Variety.	Quantity machine-dressed and sealed.	
	1930-31.	1929-30.
	Bushels.	Bushels.
Solid-straw Tuscan	1,540·5	11,006
Hunter's	98·6	4,106
Velvet	380·7	216
Dreadnought	633·9	220
Marquis	650·9	400
Garnet	379·2	..
Solid-straw Velvet	165·55	213
Yeoman	211·55	36
Totals	4,060·90	16,197

samples, and despatching particulars of each line to merchants. Mr. Veitch reports: "The demand for certified seed Tuscan was fairly good, but merchants did not seem at all anxious to secure supplies, being of opinion that there would be plenty available. Actually, owing to heavy rejections at field inspection, the reverse was the case. So far as Hunter's and other varieties were concerned, the demand appeared to fall off as compared with past seasons, but this may be accounted for by the uncertainty of prices. With regard to the scheme as worked in the past season, a few growers considered that the practice of paying a definite price to growers, as had been done in past seasons, should have been continued. So far as merchants were concerned, they appeared quite satisfied with the scheme once they had become thoroughly used to the methods, and so far as I am aware there were no complaints."

(To be concluded next month with Seed Potatoes and Seed Beans.)

CORTICIUM DISEASE OF POTATOES.

II. INDUCED DORMANCY AND TUBER-INJURY RESULTING FROM SEED TREATMENT.

E. E. CHAMBERLAIN, Mycological Laboratory, Plant Research Station, Palmerston North.

ONE of the drawbacks of seed-treatment of potatoes has always been the danger of causing tuber-injury. Treatment of seed is left by many farmers until shortly before planting, and this is the period at which tubers are most susceptible to injury. At this stage, when the potatoes are sprouting, the hot formalin and the corrosive sublimate treatments —according to the work of Dana (1925), Howitt and Evans (1926), and White (1927 and 1928)—are liable to cause considerable damage and to bring about an induced dormancy of the tubers. The acidulated corrosive sublimate treatment, which is recommended for use by the farmer in New Zealand, may be even more dangerous than the old methods if the treatment is carried out at the wrong time of the year.

TUBER-INJURY CAUSED BY TREATMENT WITH ACIDULATED CORROSIVE SUBLIMATE.

The present experiment, the results of which are presented in Table 1, was designed to ascertain the damage-limits in time and strength of acidulated corrosive sublimate dips. Five washed tubers from a single line of Epicure variety potatoes were used for each treatment. The tubers were examined four days after treatment, and the effect of the dip estimated from the relative amount of pitting observed.

Table 1.

(.. = no pitting; L = slight pitting; M = moderate pitting; S = severe pitting.)

Strength of Solution.	Length of Dip.				
	30 Min.	45 Min.	60 Min.	75 Min.	90 Min.
1–6·6–1,000*	..	..	..	..	L
1–6·6– 900	..	..	..	L	L
1–6·6– 800	..	..	L	M	M
1–6·6– 700	..	L	M	M	S
1–6·6– 600	L	M	M	S	S
1–6·6– 500	L	M	M	S	S
1–10–1,000	..	..	..	L	L
1–10– 900	..	..	L	L	M
1–10– 800	..	L	M	M	S
1–10– 700	L	M	M	S	S
1–10– 600	M	M	S	S	S
1–10– 500	M	M	S	S	S

* 1–6·6–1,000 = 1 part corrosive sublimate, 6·6 parts concentrated hydrochloric acid, and 1,000 parts water.

The pitting referred to is the formation of depressions on the surface of the tuber (Fig. 1). These depressions take place at the lenticels or at any wound on the tuber. The pits may occur as mere depressions, but in more severe cases the tissues in the vicinity of the pit are injured and the depression becomes dark-coloured.

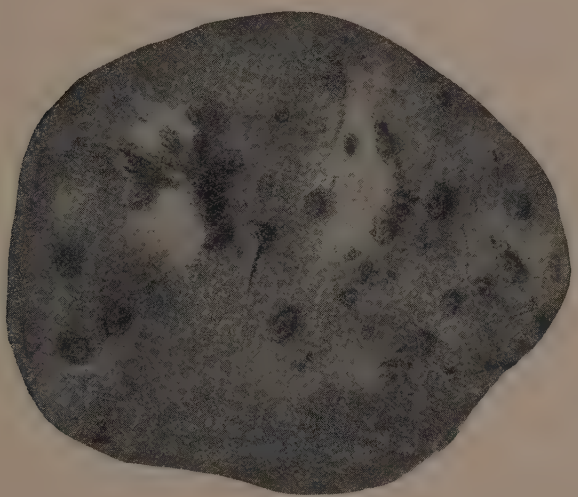


FIG. 1. POTATO PITTED BY TREATMENT WITH ACIDULATED CORROSIVE SUBLIMATE.

The pitting in itself does not do the tubers any serious damage, but it indicates that the treatment is liable to injure the eyes of the potatoes. However, if the treatment is carried out while the tubers are dormant it is safe to use a treatment which causes mild or even moderate pitting. This is shown by the results of an experiment using 100 tubers per treatment from the same line of Epicure as in the previous experiment. Sufficient seed-size tubers were not available, so that some of the treatments were carried out on table potatoes, and these were cut immediately before planting. Both the seed-size and table potatoes had been treated fifteen weeks before planting. Details of the experiment and the results are shown in Table 2 (next page).

From a comparison of the germination of the corticium-infected untreated lines with those treated lines showing slight or moderate pitting it may be seen that the treatment has had little or no detrimental effect on the germination. Where severe pitting occurred the treatment has brought about an induced dormancy and has also killed some of the tubers. That both corticium infection and treatment cause some delay in germination is shown by the higher germination counts for the corticium-free untreated line.

The table gives a certain amount of evidence which indicates that the cut table are less affected by treatment than are the seed-size

Table 2.

Tubers.	Strength of Solution.	Length of Dip.	Degree of Pitting.	Germination Percentage after 4 Weeks.	5 Weeks.	11 Weeks.
Seed-size.		Min.				
Untreated corticium free ..	..	..	None ..	34	97	100
Untreated corticium infected ..	..	..	None ..	17	74	99
Treated corticium free ..	1–6·6–1,000	90	Slight ..	21	87	96
Treated corticium infected ..	1–6·6–1,000	90	Slight ..	9	72	95
Treated corticium infected ..	1–10–500	90	Severe ..	4	32	71
Cut Table.						
Untreated corticium infected ..	..	..	None ..	20	84	99½
Treated corticium infected ..	1–6·6–600	60	Moderate	22	93	100
Treated corticium infected ..	1–6·6–500	60	Moderate	20	88	99
Treated corticium infected ..	1–6·6–800	90	Moderate	26	88	99
Treated corticium infected ..	1–10 –700	60	Moderate	29	89	97

potatoes. That this is so with the variety in question, Epicure, is borne out by other experimental evidence, and this is shown in the following table :—

Table 3.

Date of Germination Count.	Germination Percentage. Treated. Seed.	Treated. Cut Table.	Untreated. Seed.	Untreated. Cut Table.
26th November, 1930	0	23	33	61
3rd December, 1930	7	66	90	93
8th December, 1930	27	88	97	94
12th December, 1930	52	93	97	97
16th December, 1930	58	94	97	97
Number of tubers in trial ..	60	140	30	70
Yield in tons per acre ..	1·3	4·1	3·8	4·6

These potatoes were treated by the standard acidulated corrosive sublimate method* immediately before planting, the table size being cut after treatment, and the planting itself was carried out late in the season. Consequently neither the treated nor the untreated potatoes did well, and the stronger growth of the cut table is evident even in the untreated line. That these differences are due only to the ability of the table potatoes to better withstand adverse conditions, and not to any superior yielding-power, is shown by the results of a yield trial of cut table versus seed-size carried out at the normal planting-time.

* The standard acidulated corrosive sublimate treatment referred to here and elsewhere in the article is as follows : The potatoes are soaked for one hour and a half in a solution of 1 part corrosive sublimate, 6·6 parts concentrated hydrochloric acid, and 1,000 parts water. This treatment has been recommended by the Mycological Laboratory and used in New Zealand for several years, although the method has not been published.

These results, obtained from a trial of 250 sets seed and 250 sets cut table grown in ten replications of twenty-five sets each, are as follows: Seed, 1·85 tons per acre; cut table, 1·63 tons.

Varietal Susceptibility to Tuber Injury.

Observations made while treating seed potatoes for corticium control show that the various varieties react quite differently to treatment. This was also noted by Braun. (1928). The following table records an experiment on the effect of one treatment on a number of varieties :—

Table 4.

Variety.	Number of Tubers treated.	Percentage of Tubers killed.
Majestic	20	25
Duke of York	40	12
Bresee's Prolific ..	20	10
Witchhill	27	8
Arran Chief	50	6
Great Scot	100	6
Field Marshal	50	4
Kerr's Pink	100	2
King Edward	70	1·5
Herald	70	..
Up-to-date	120	..
Epicure	120	..

The tubers were listed as killed when all the eyes had failed to sprout, even after they had been allowed to green for two months. All the potatoes in this trial had been grown in one plot and lifted on the same date. There was no correlation between the amount of killing and the extent to which the different varieties had sprouted at the time of treatment. Thus the variety Epicure showed the greatest sprouting and yet none of the tubers were killed. The table does not take into consideration the amount of pitting which took place on the varieties treated, but some varieties do pit much more severely than others. Thus in a line of Aucklander Tall-tops and a line of Epicure which were treated together in the same container, the Aucklander Tall-top tubers showed severe pitting while the Epicure showed no injury. Factors such as time of lifting, maturity of skin, method of storage, &c., are all likely to have an influence on the injury caused by treatment. In general, it appears that those varieties with deeper eyes show less actual killing than those with shallow eyes, Epicure in particular being resistant to tuber-injury.

Induced Dormancy as a Result of treating Seed immediately prior to Planting.

During the 1929–30 and 1930–31 seasons trials were carried out at the Plant Research Station on the comparative yields of corticium-infected Epicure potatoes untreated and treated by the standard acidulated corrosive sublimate treatment. The seed, which was well sprouted, was treated twelve hours before planting. The treatment caused a marked delay in the germination of the potatoes, and some failed to germinate. The accompanying graph (Fig. 2) shows the

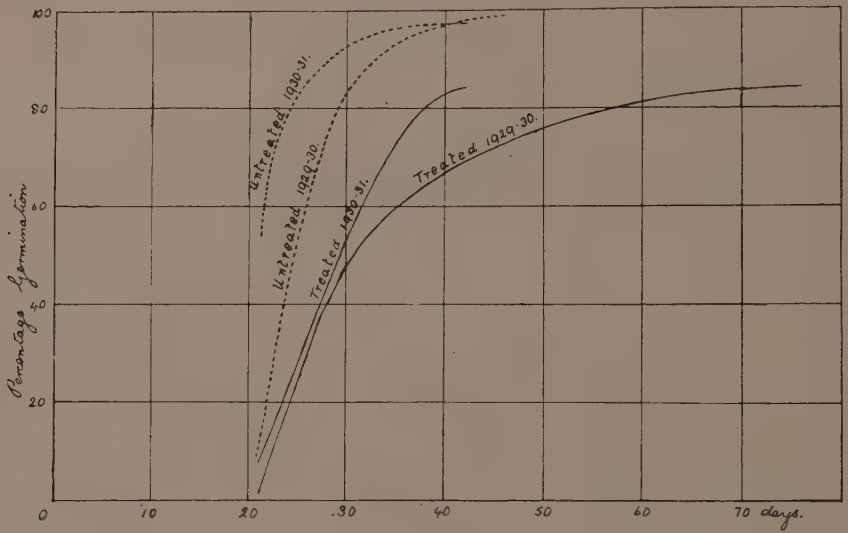


FIG. 2. GRAPH SHOWING INCIDENCE OF INDUCED DORMANCY.

extent of the delay, and also the percentage of misses caused by the treatment during the two seasons. The trial in 1929–30 involved 300 treated and 125 untreated sets planted in replications of twenty-five sets per plot. In the 1930–31 trials 200 treated and 100 untreated sets were planted in replications of ten sets per plot.

The yield trials results for the two seasons were as follows :—

Table 5.

	1929–30.	1930–31.
Treated	8·2 tons per acre	3·45 tons per acre.
Untreated	9·25 tons per acre	4·4 tons per acre.

Besides this evidence obtained at the Plant Research Station there have been several reports of injury caused by treatments carried out on a larger scale. Among these may be cited the treatments carried out by the Fields Division for corticium and powdery scab control trials at Tuatapere, Southland, in 1930–31. Two sacks of potatoes of the variety Up-to-date were treated by the standard acidulated corrosive sublimate method during September, 1930. This treated seed was planted on 30th October, 1930, in a block at one end of a crop of potatoes, and according to the report of the Fields Instructor, Mr. A. S. Duff, who examined the crop on 22nd January, 1931, only about one-sixth of the treated seed had germinated. Another examination of the crop was made on 1st March, and it was reported that one-fifth to one-quarter of the treated seed had grown, while the untreated seed had done well and produced vigorous plants. Since the experiment was being carried out to demonstrate disease-control only, no yield figures were taken.

From the foregoing experiment it is apparent that it is dangerous to treat potatoes immediately before planting, but that treatments carried out at the correct time have no detrimental effect on the tubers. This is borne out by the published results of experiments elsewhere by Dana (1925), Howitt and Evans (1926), White (1927 and 1928), and Braun (1928).

In an attempt to determine which was the most suitable time to treat, a series of experiments was carried out during the winter of 1929. Commencing five months before planting, lots of fifteen tubers from one line of Epicure were treated at fortnightly intervals with the standard acidulated corrosive sublimate treatment. The final treatment was made on 7th October, and the whole series was planted on the following day. The results of this trial are shown in the following table :—

Table 6.

Series No.	Date of Treatment.	Number germinated after Twenty-one Days.	Yield (Table and Seed).
			lb.
C. 1 ..	15th May, 1929	13	34·2
C. 2 ..	29th May, 1929	12	32·0
C. 3 ..	12th June, 1929	12	31·1
C. 4 ..	26th June, 1929	14	27·5
C. 5 ..	9th July, 1929	13	33·7
C. 6 ..	25th July, 1929	12	29·8
C. 7 ..	9th August, 1929	10	22·3
C. 8 ..	22nd August, 1929	6	16·4
C. 9 ..	10th September, 1929 ..	5	13·2
C. 10 ..	23rd September, 1929 ..	..	3·5
C. 11 ..	7th October, 1929	1	28·2

The plants of series C. 1 to C. 6 came away together and appeared to do equally well throughout the season. No. 7 did not come away quite so quickly as Nos. 1 to 6, but later in the season could not be distinguished from them. Nos. 8 and 9 were very definitely delayed, and No. 10 did not do at all well, most of the tubers being quite dormant. No. 11 was very slow in appearing through the ground, but when it did show was very even and made good growth.

In this case treatment immediately prior to planting, though it delayed growth, did not materially reduce the yield, but that it may do so is evident from the experimental data given earlier in this article. The table also shows that in order to avoid damage the treatment should be carried out ten weeks before planting. Since in these experiments Epicure potatoes were used, and since Epicure is a variety which is not so susceptible to tuber-injury as are most varieties, ten weeks is probably a conservative estimate.

During the past three years quite large quantities of seed potatoes have been treated by the standard acidulated corrosive sublimate method at the Ashburton Experimental Farm. The treatment is carried out about four months before planting, and, although a certain amount of pitting occasionally occurs, in no case has the treatment affected either the germination or the growth of the plants from the treated seed.

CONCLUSION.

These experiments show that where the acidulated corrosive sublimate dip is used the seed potatoes should be treated four months before planting. If the treatment is delayed to within a few weeks of planting it should be carried out immediately before planting, as this will tend to minimize somewhat the injury which will follow the late treatment.

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GREEN GRAFTING OF THE GRAPE-VINE.

METHOD INTRODUCED FROM DALMATIA.

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A METHOD of herbaceous grafting of grape-vines introduced by Dalmatian settlers into New Zealand a few years ago is giving very good results in the North Auckland District, and bids fair to increase in popularity among the vignerons. It differs from the Allies, Condurso, and Horvath green grafting methods, resembling more closely that proposed by Hortoles in the *Revue Horticole* for August, 1876, and recommended by H. Goethe in Austria about the same period. It is not unusual in New Zealand for practised vignerons to obtain 95 to 100 per cent. of perfect unions by this method, and the writer is informed that all other methods of grafting vines have been abandoned in its favour in Dalmatia.

It is usual when employing the method in field grafting to plant the stock cuttings in permanent positions, and the scion wood in the row half way between the stocks. The grafting is usually performed when the rootlings are in their second leaf, weak vines a season later, and misses can be worked with a "Yema" or bud graft, which it is hoped to describe in a later article. When the grafted vines have grown sufficiently to fill all the space in the row the ungrafted vines are uprooted, after having produced one or two crops of grapes (if they are of an early bearing variety) and furnished scion wood for grafting.

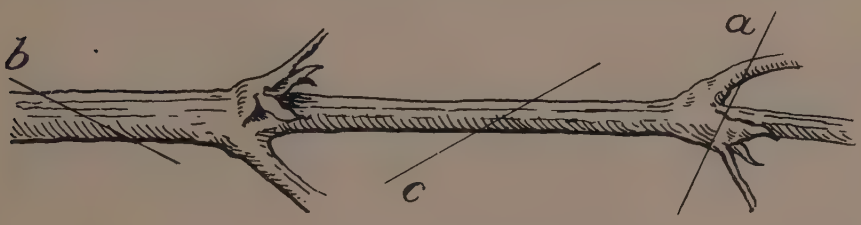
Following are a few notes gathered in the field by the writer with the object of assisting beginners in the execution of this method of green grafting:—

(1) The graft, which is a simple splice or whip graft without a tongue, is executed when the vines are in flower, in December in New Zealand.

(2) The scion and stock should be of the same thickness and quite green—not turning yellow—and tough enough to withstand bending without snapping. On being cut no sign of lignification in the form of a whitish ring should be visible.

(3) A scion consists of two nodes and two inches of internode below the bottom node, or may consist of one bud only with two inches of internode above and below the node. The two-noded form is generally preferred.

(4) The accompanying sketch illustrates the method. To prepare the longer scion a cut (*a*) is made from below the top bud in a slanting direction upwards, so as to cut out the bud completely and leave the diaphragm intact. The second cut (*b*) is made from the same side of



the scion as the top cut, beginning 2 in. below the bottom node and at an angle of approximately 30 degrees. The shorter scion is cut at an angle of 30 degrees from the opposite side to the bud, and approximately 2 in. above and below it at (*b*) and (*c*).

(5) The stock is cut upwards from about 2 in. above the third or fourth bud, preferably so that the bud below the cut will be on the opposite side of the stock to that on the scion; but always so that the bud on the scion points upwards when grafted.

(6) The cut surfaces of the scion and stock at their point of contact should be of equal length and breadth and as short as consistent with the binding of a close-fitting firm union. Cut surfaces of an angle of approximately 30 degrees fulfil these requirements.

(7) The leaves are trimmed off the scions and allowed to remain on the stocks; all sublaterals are broken out.

(8) Suitably developed shoots $\frac{1}{4}$ in. or more in diameter are generally available on average soils when the rootlings are in their second leaf, when two or more shoots of the stock, according to its vigour, can be grafted and the surplus cut out.

(9) In working over old vines green shoots growing from spurs left at the previous pruning for the purpose, or suitably placed water-shoots, can be grafted. Cropping is continued on the mature vines while they are being worked, so that no loss is sustained.

(10) Green shoots from which scions are intended to be cut are gathered as required and kept fresh in a piece of damp cloth or sacking, and the scions are cut from them as each graft is made.

(11) The best results can be obtained by grafting in the early morning or in the evening. On dull days good results can be obtained all day long.

(12) Thin rubber ribbon $\frac{3}{16}$ in. in width and very resilient is used for the binding, which is commenced $\frac{1}{2}$ in. below the cut on the stock with a half-hitch and continued to $\frac{1}{2}$ in. above the union, where it is secured with another half-hitch. The coils of the binding should overlap slightly, so as to keep out the air and keep in the sap. A cigarette paper is wrapped round the binding and gummed in place to protect it from the sun, or a vine leaf may be tied round it. The sap oozes from the top of the scion two to three hours after the operation is completed, and if the scion does not shrivel after three or four days a satisfactory union is assured. The binding should be taken off a couple of months later. The shoots growing from the scions should be attached to supports to safeguard them from the effects of strong winds.

It is suggested by the writer that the rubber ribbon which is employed for filling golf balls, and which is $\frac{3}{4}$ in. in width and very thin and resilient, could be used with advantage for binding the grafts. It could be wrapped round the unions without the aid of a half-hitch, and rolled back a little from the top to hold it in place. Both types of rubber ribbon can be obtained from the New Zealand Fruitgrowers' Federation, Ltd.

The most suitable knives for this and other methods of grafting vines are bevelled on one side of the blade only, like Wostenholm's garden knife, and should have a razor edge kept keen with the aid of a portable stiff strop or razor hone.

A few vignerons are of the opinion that scions showing signs of lignification in the form of a faint white ring when cut may be used with success, but that this should not be visible in the stock. Also they are of opinion that it is preferable to gather the scion shoots the previous evening and stand them in water all night before making use of them; and that in case they are unavoidably gathered the same day they are to be grafted their value can be increased by leaving them an hour or two in the sun to wilt slightly.

WHEAT-MANURING EXPERIENCE IN CANTERBURY.

THE following note is extracted from the October issue of the *Wheatgrower* (organ of the N.Z. Wheatgrowers' Co-operative Association):—

In a series of very sound manurial experiments conducted over the past seven or eight years the Department of Agriculture has demonstrated that the effect of applying 1 cwt. of super with the seed at wheat-sowing increases the yield, on an average, by about 5 or 6 bushels per acre. In the main, farmers have accepted the value of this, and have applied superphosphate with their wheat; however, this year, owing to the economic conditions, some farmers took the risk of sowing some of their wheat without manure.

At a recent meeting of the Farmers' Union held at Springston one farmer present stated that he sowed some wheat this year on a fallowed piece of good land, and ran out of manure when he had still 4 acres to do to finish the paddock. He did not bother to get any more manure. He stated that the manured portion of the field is looking healthy, with a vigorous growth, whilst the part not manured appears as though a fire had gone over the paddock. It is looking brown, and it seems as though the non-manured portion will yield many bushels less than the manured. Somewhat similar experiences have been recorded in South and Mid Canterbury.

Whilst super is most important for autumn-sown wheat, it is even more important for spring-sown, the crop having a shorter period in which to find its food-supply and develop its grain.

GORE EXPERIMENTAL AREA.

REPORT ON WORK IN SEASON 1930–31.

R. B. TENNENT, Fields Superintendent, Department of Agriculture, Dunedin.

DURING the season of 1930–31 a considerable amount of experimental work upon crops and pastures was carried out at the Gore Experimental Area, and new light has thereby been thrown upon some of the farming problems of the South. Despite a late spring and wet summer, the various crops under experiment grew excellently, particularly in the case of root crops, which yielded much above the averages generally experienced on the Area. The following matter briefly summarizes the work carried out during the season.

CONTROL OF CLUB-ROOT IN TURNIPS AND SWEDES.

As in past years considerable attention was given to experiments designed to combat the effect of club-root on turnips and swedes, a disease of considerable economic importance in the South. The trials can be divided under two main groups, the first being a continuance of tests of the resistant qualities of so-called disease-resistant varieties, and the second a series of trials to determine the effect of the application of various ingredients to the soil.

TRIAL OF RESISTANT VARIETIES OF SWEDES.

Seven lines of swede seed were put under trial on land which had grown a crop of turnips in 1928, and had been green-manured with lupins in 1929. This land was known to be badly infested with club-root and afforded an excellent opportunity to ascertain the disease-resistant qualities of the various lines growing thereon.

In the trials five different lines of Hernings swede seed were included, each line being derived from separate commercial sources. The other varieties were Bangholm-Studgaarde, and Wilhelmsburger Otofte, two Danish varieties. As a control a popular commercial swede named Knockdon was used, this being a typical representative of the commercial lines of purple-top swedes on the market, and usually yielding well on good disease-free ground. Owing to the lateness of the season, the trial could not be sown until 12th December, 1930, the seed being drilled on raised ridges with a Planet Jr. machine at the rate of 1 lb. per acre. The manure used was a mixture of 2 cwt. of 44–46 per cent. superphosphate and 1 cwt. sulphate of potash, at the rate of 3 cwt. per acre. The plots were laid down in a series of nine replications.

The crop was singled on 22nd January, 1931, all varieties having germinated evenly. At this date club-root was only discernible on the control swede Knockdon, the other varieties being free from the disease and growing well. From the beginning of March onwards club-root began to show up in all varieties, but two lines of Hernings (Department of Agriculture seed) and Wilhelmsburger Otofte appeared to be more resistant than the remainder. On that portion of the field, which is low, badly drained, and heavily infected with club-root, all the varieties with the exception of these two had completely succumbed to the unfavourable conditions.

The trial was brought to a conclusion on 25th July, 1931, when weighings were taken of the different plots and a close macroscopic examination made for the presence or otherwise of club-root. The following results were obtained :—

Table 1.—Summary of Yields and Club-root-infection Counts.

Plot No.	Variety.	Yield in Tons per Acre.	Percentage of Infection.	Number of Roots examined.
1	Hernings (Department of Agriculture)	12·5	58·9	511
2	Bangholm-Studgaarde ..	13·5	72·5	634
3	Hernings (W.R.) ..	11·9	68·2	522
4	Wilhelmsburger Otofte..	16·8	53·4	614
5	Hernings (N.B.) ..	11·2	71·8	479
6	Bangholm Hernings ..	11·2	56·8	578
7	Hernings (J.W.) ..	12·4	57·9	598
8	Knockdon (control) ..	5·3	99·6	306

It will be noted from the table that several lines of Hernings obtained from different sources showed considerable variation in yield and disease counts, but each strain was considerably superior to the commercial control Knockdon. Wilhelmsburger Otofte stood out prominently in this trial as a swede which should receive considerably more attention with growers. The Department of Agriculture's line of Hernings swede has again shown a marked resistance to club-root, and selection of the most resistant roots for seed-production has been carried out. The generally low yields obtained are due to the poor soil upon which the trial was carried out and to the heavy infection of club-root present in the soil.

EFFECT OF SOIL-TREATMENT.

Previous investigations in regard to the use of lime on land infected with club-root have been carried out at the Gore Area, but the results obtained have in the past not met with much success. At the instigation of the Mycologist, a trial to determine the effect of pre-liming the land some few months prior to sowing the turnip crop was carried out, and promising results are to be recorded. Block 6 was chosen for this experiment, as it was known to be heavily infected with club-root, having grown a badly diseased crop of turnips in 1928. A green crop of blue lupins was ploughed under in 1929. Eight plots approximately 52 ft. in width by 4 chains in length were utilized in this trial, and the four following treatments were duplicated :—

(1) Plot A—No lime. Plot B—Ground burnt lime, 3 tons per acre. Plot C—Ground burnt lime, 1⅔ tons per acre. Plot D—Carbonate of lime, 3 tons per acre. An essential point to note is that the plots received lime on 22nd and 23rd September, 1930, approximately three months prior to the seed being sown.

(2) The swedes were sown in raised drills on 19th December, 1930, all plots being manured with basic slag at the rate of 2½ cwt. per acre, with the exception of half of Plot A (designated A1) which was sown with carbonate of lime plus superphosphate mixed in equal proportions,

at the rate of 6 cwt. per acre. Superlative swedes were sown on this latter plot on account of a shortage of the Knockdon variety which was sown throughout the remainder of the trial.

(3) Germination counts were taken prior to the crops being thinned on 21st January, 1931, the relative germinations of treatments being as follow :—

Table 2.—Germination Counts.

Plot No.	Treatment per Acre.		Average Number of Plants per Area 10 ft. by 26 in.
	Prior to sowing.	Sown with Seed.	
A1	No lime	Super 3 cwt. plus carbonate of lime 3 cwt.	29·6
A2	No lime	Basic slag 2½ cwt. ..	35·3
B	Burnt lime 3 tons ..	,, ..	40·4
C	Burnt lime 1⅔ tons ..	,, ..	37·1
D	Carbonate of lime 3 tons	,, ..	35·3

(4) The plots were kept under constant observation, and it was early apparent that in the case of Plots A1 and A2 club-root was causing serious damage, whereas in the remaining plots, which had received lime, apparently good yielding crops would be harvested. By the time the experiment was harvested, on 9th July, 1931, the difference between the unlimed plots and the limed was astounding, as shown by the following table :—

Table 3.—Summary of Yields.

Plot.	Treatment per Acre.		Yield per Acre.	Average Weight per Root.
	Prior to sowing.	Sown with Seed.		
			Tons.	lb.
A1	No lime	Super 3 cwt. plus carbonate of lime 3 cwt.	1·7	0·47
A2	No lime	Basic slag 2½ cwt. ..	6·5	0·99
B	Burnt lime 3 tons ..	,, ..	19·9	1·94
C	Burnt lime 1⅔ tons ..	,, ..	17·8	1·96
D	Carbonate of lime 3 tons	,, ..	18·4	2·11

(5) Disease counts were also taken at time of harvesting the crop, the following particulars being obtained :—

Table 4.—Incidence of Disease showing at Harvesting.

Plot.	Average Infection per Row.			Percentage of Infection.		
	Number badly infected.	Number slightly infected.	Number free from Infection.	Badly infected.	Slightly infected.	Free.
A1	12·7	0	0·6	95·2	0	4·8
A2	22·6	1·6	0	93·4	6·6	0
B	7·9	17·6	12·3	21·0	46·4	32·6
C	11·3	16·8	5·5	33·6	50·0	16·4
D	8·5	16·9	6·7	26·4	52·6	21·0

It will thus be seen that, apart from giving increased yields, the percentage incidence of the disease was considerably reduced on those plots which received lime.

TRIAL OF CONTROL EFFECT OF OTHER MATERIALS.

Apart from the foregoing trials, preliminary observations were carried out in regard to the control effect of starch, calcium cyanamide, calcium carbide, and sulphur when applied to "clubbed" land prior to the growing of swedes. This experiment was of a purely observational nature, and in this connection the following points are to be recorded :—

Starch : Ordinary commercial starch was presown on the plots at the rate of 214 lb. per acre, but no control effects were noted.

Calcium Cyanamide : Although in the initial stages a dressing of calcium cyanamide, sown at the rate of 263 lb. per acre, encouraged vigorous growth, by the time the crop matured all bulbs were badly infected with club-root, no control effect having been observed.

Calcium Carbide : Indications were given that further work with this material is justified, dressings of carbide dust at the rate of 224·5 lb. per acre controlling the disease to some extent.

Sulphur : A dressing of sulphur at the rate of 389 lb. per acre proved most damaging to the crops, resulting in total failure and death of all plants.

CONCLUSIONS.

As a result of the season's work the following points call for remark :—

(1) Hernings, Wilhelmsburger Otofte, and Bangholm-Studgaarde swedes show a marked resistance to club-root, being considerably superior to the commercial control.

(2) Preliming the land, either with burnt lime or ground carbonate of lime, in quantities as indicated, some three months prior to sowing the crop, has been most effective in controlling the infection.

(3) The use of basic slag at the rate of 2½ cwt. per acre drilled with the seed on prelimed land appears warranted.

(4) The use of equal parts of carbonate of lime and superphosphate, drilled with the seed at the rate of 6 cwt. per acre, does not control club-root.

(5) Further experiments using calcium carbide dust as a dressing in "clubbed" land appear warranted.

(6) Further experiments in regard to the use of superphosphate as a fertilizer of prelimed land are advocated.

(7) Serious damage results from the use of sulphur, and no material benefits were recorded for the use of starch or calcium cyanamide.

Oats Manurial Trial.

A further Type C trial in regard to the effect of nitrate of soda and sulphate of ammonia in conjunction with superphosphate for the manuring of oats met with negative results. The field used for this experiment was ploughed out of lea in 1928, grew a mangold crop in 1928–29, and potatoes in 1929–30. Garton oats were sown at the

rate of 165 lb. per acre on 13th October, 1930, and the crop was cut and weighed for green weight prior to stooking on 10th March, 1931. Further dry weights were taken on 28th March, 1931.

The treatments per acre were as follow:—

(1) Super 2 cwt.
(2) Super 2 cwt., plus sulphate of ammonia 1 cwt. when plants 1–2 in. high.
(3) Super 2 cwt., plus nitrate of soda 1 cwt. when plants 1–2 in. high.
(4) Super 2 cwt., plus sulphate of ammonia 1 cwt. when plants 4–6 in. high.
(5) Super 2 cwt., plus nitrate of soda 1 cwt. when plants 4–6 in high.

The nitrogenous manures were applied by hand to Plots 2 and 3 on 4th November, 1930, and to Plots 4 and 5 on 18th November. Yields from the various treatments are shown in Table 5. None of the differences are statistically significant.

Table 5.—Summary of Yields.

Treatment per Acre.	Yield in Tons per Acre.		
	Green Weight.	Weight on Stacking.	Dry Weight as Percentage of Green Weight.
(1) Super 2 cwt.	9·7	4·5	46·7
(2) Super 2 cwt., plus sulphate of ammonia 1 cwt. (4th November, 1930)	10·1	4·7	46·4
(3) Super 2 cwt., plus nitrate of soda 1 cwt. (4th November, 1930)	10·3	4·8	45·9
(4) Super 2 cwt., plus sulphate of ammonia 1 cwt. (18th November, 1930)	9·9	4·6	46·9
(5) Super 2 cwt., plus nitrate of soda 1 cwt. (18th November, 1930)	9·8	4·5	45·2

Observations by Overseer: 17th January, 1931—There are no differences between treatments, except that super alone is lighter in colour than the rest. 10th March, 1931—At time of cutting there did not appear to be any differences; small birds had been destructive, and the crop was badly lodged.

The conclusion from this season's trial is that the use of nitrate of soda or sulphate of ammonia for the manuring of oats when used in conjunction with superphosphate has not been warranted.

Turnip Variety Trial.

A trial of different varieties of turnips was conducted on the Area during the season. Eleven varieties were put under test, sown on 9th December, 1930, at the rate of 1 lb. of seed per acre, the fertilizer being a mixture of superphosphate, lime, North African phosphate, and potash, at 3 cwt. per acre. All varieties were replicated five times. The yields obtained are shown in Table 6 (next page).

It will be seen that No. 11 has a significantly higher yield than all the other varieties except No. 9. Variety No. 9 is significantly better than the remainder, except Nos. 10 and 11. The yield of variety No. 8 is significantly lower than that of the other varieties, except Nos. 1 and 3.

Table 6.—Turnip Variety Yields.

Plot No.	Variety.	Yield in Tons per Acre.
1	Carter's Champion Green-top Yellow Hybrid	19·7
2	Carter's Imperial Green Globe	22·2
3	Yellow Tankard Pajbjerg V	19·2
4	Carter's Champion P. T. Hybrid	28·1
5	Carter's Yellow Vale	26·9
6	Dale's Hybrid Amageraard V	28·5
7	Fynsh Bortfelder Hundsler V	28·7
8	May Turnip Marienlyst V	17·7
9	Grey Stone Amagergaard V	33·4
10	White Tankard Roskilde V	31·5
11	Carter's Improved Purple-top Mammoth	36·6

REMARKS ON VARIETIES.

No. 1: A long green-top white-fleshed turnip with good leafage. The root is cone-shaped with a long tapering tap-root. This turnip grows well out of the ground, and would be excellent for folding sheep upon. Its flesh is soft, and it requires to be fed off early in the season, as it is not a good keeper. It is fairly susceptible to club-root.

No. 2: A green-top turnip with general characteristics similar to No. 1, but apparently not so susceptible to club-root. Quite excellent for feeding to both cattle and sheep. Has a good crown, and on this account may not be so susceptible to dry-rot as other green-top types.

No. 3: A green-top white-fleshed tankard type. Bulb long and narrow, growing well out of the ground. Owing to this feature it is not well suited to feeding sheep upon, owing to the tendency of the roots to be knocked out of the ground. Excellent for hand-pulling and early cattle feeding. Appears susceptible to club-root.

No. 4: A purple-top of good shape with a good tap-root. Appears to be a good all-round early suited to Southland conditions, and should prove excellent for sheep and cattle.

No. 5: This green-top turnip is one of the best in the series and is highly commended. It is ball-shaped with a small tap-root, and should be good for cattle and sheep.

No. 6: A green-top turnip with well-shaped bulb, and is a quick grower. The flesh is white and soft. This variety is suitable for early feeding off, but takes club-root badly.

No. 7: A green-top variety which grows well out of the ground, making the crop easy to lift. Does not, however, appear to be particularly valuable for sheep-feeding on this account. Not resistant to club-root.

No. 8: A green-top variety with a nicely shaped bulb which has a long tap-root. The flesh is soft, but of good colour. An excellent turnip for feeding, but apparently a low yielder.

No. 9: A good-yielding purple-top turnip of good shape. The flesh is soft and does not keep well. Excellent for early feeding, but very susceptible to club-root.

No. 10: A good-yielding purple-top tankard, which grows well out of the ground, inclining to bend over. Excellent for pulling or cattle feeding, but unsuited for feeding-off with sheep.

No. 11: A good purple-top turnip with a well-shaped bulb and small tap-root. Although liable to club-root it is an excellent turnip for sheep and cattle feeding.

Turnip Manurial Experiment.

With a view to ascertaining what damage, if any, resulted to seed sown with varying quantities of superphosphate and a mixture of super and lime, further experiments were conducted on the area during the season under review. The field selected for the trial had grown a crop of oats in the season 1928–29, and a crop of lupins was ploughed under in 1929–30. Green-top Aberdeen turnip seed was ridged at the rate of 1 lb. per acre, and ten replications of the following manurial treatments were carried out:—

Table 7.—Turnip Manurial Treatments.

Plot No.	Treatment per Acre.	Manure sown through Front Box of Ridger, per Acre.	Manure sown through Rear Box of Ridger, per Acre.
		Cwt.	Cwt.
1	Super 3 cwt.	3	..
2	Super 3 cwt.	2	1
3	Super 3 cwt.	1½	1½
4	Super 3 cwt., lime 3 cwt. ..	4	2
5	Super 3 cwt., lime 3 cwt. ..	3	3

It is to be noted in connection with these treatments that in the case of manure being sown through the rear box of the ridger such falls with the seed. Manure sown from the front box of the ridger, however, falls below the seed. It has been contended that where too great a quantity of superphosphate is sown in conjunction with the seed germination-damage occurs and the crop is materially reduced. It has further been asserted that if super and carbonate of lime are mixed some time prior to being drilled with the seed the damaging effect of super is overcome. In the treatments enumerated above super had been mixed with carbonate of lime some fourteen days prior to the crop being sown. The crop was sown on 6th December, 1930, germination counts were taken on 16th January, 1931, and the crop finally harvested and weighed on 26th May, with the results shown in Table 8. In this connection it is to be pointed out that the average numbers of plants are the averages of 100 counts, and each yield figure given is the average of forty weighings.

Table 8.—Summary of Yields and Germination Counts in Turnip Manurial Trial.

Plot No.	Treatment per Acre.	Front Box.	Rear Box.	Average Number of Plants per 10 ft.	Relative Germination. (Super 3 cwt. plus Lime 3 cwt. = 100.)	Yield per Acre.
		Cwt.	Cwt.		Per Cent.	Tons.
1	Superphosphate 3 cwt. ..	..	3	54·4	88·6	30·8
2	Superphosphate 3 cwt. ..	1	2	27·9	45·4	26·9
3	Superphosphate 3 cwt. ..	1½	1½	27·5	44·7	25·1
4	Super 3 cwt. plus lime 3 cwt.	2	4	57·6	93·8	29·8
5	Super 3 cwt. plus lime 3 cwt.	3	3	61·4	100·0	30·8

The germinations of treatments No. 2 and No. 3 is significantly lower than those of other treatments.

In regard to yield, treatment No. 1 is significantly better than treatments Nos. 2 and 3; treatment No. 2 is significantly better than treatment No. 3; treatment No. 4 is significantly better than treatment No. 2; while the yield given from treatment No. 5 is significantly greater than that obtained from treatment No. 3.

Conclusions.—This experiment has conclusively shown that under the conditions prevailing at Gore during the season 1930–31 superphosphate, when sown at the rate of 1 cwt. and 1½ cwt. per acre with the seed, considerably lowered germination and resulted in lessened yield. It would appear from the results that super should not be sown in direct contact with the seed, the safest procedure being to sow a mixture of equal parts of carbonate of lime and super as in treatment No. 5, the mixing to be carried out at least seven days prior to use.

Swede Manurial Experiment.

A manurial experiment upon swedes was also conducted, this being an exact duplicate of the foregoing turnip manurial trial. Superlative swede seed was sown on 4th December, 1930, and the crop was harvested and weighed on 30th May, 1931, with results shown in Table 9. The average numbers of plants are the average of 100 counts, and each yield figure is the average of thirty weighings.

Table 9.—Swede Manurial Trial.

Plot No.	Treatment per Acre.	Front Box.	Rear Box.	Average Number of Plants per 10 ft.	Relative Germination. (Super 3 cwt. plus Lime 3 cwt. = 100.)	Yield per Acre.
		Cwt.	Cwt.		Per Cent.	Tons.
1	Superphosphate 3 cwt. ..	3	..	34·0	86·3	30·5
2	Superphosphate 3 cwt. ..	2	1	25·9	65·7	25·9
3	Superphosphate 3 cwt. ..	1½	1½	17·6	44·6	23·8
4	Super 3 cwt. plus lime 3 cwt.	4	2	39·4	100·0	29·9
5	Super 3 cwt. plus lime 3 cwt.	3	3	37·2	94·8	29·7

Germination differences greater than 3·1 plants per 10 ft. may be regarded as statistically significant.

With respect to yields, treatment No. 1 is significantly greater than both treatments No. 2 and No. 3; the difference between the two latter is not significant. The yield from treatment No. 4 is significantly better than that obtained from treatment No. 2, while No. 5 is significantly better than No. 3.

Conclusions.—The remarks made in connection with the turnip manurial experiment also apply to this trial with swedes. It is quite evident from the table that superphosphate sown in conjunction with swede seed affects germination and yield. Where super alone is being used to manure the crop, this should be sown through the front box of the ridger. Where it is desired to sow some manure with the seed, a mixture of carbonate of lime and super is recommended.

SWEDE VARIETY TRIAL.

A variety trial of swedes was carried out with a view to obtaining some information as to the relative yielding ability of certain varieties as compared with the Knockdon swede. The field upon which the trial was conducted had previously been in oats. The crop was sown on 8th December, 1930, with 3 cwt. of superphosphate per acre, and harvested on 2nd June, 1931, with the following results :—

Table 10.—Summary of Yields in Swede Variety Trial.

Plot No.	Variety.	Yield in Tons per Acre.
1	Knockdon	25·7
2	Carter's Holborn Elephant	24·7
3	Carter's Holborn Prizewinner	24·6
4	Carter's Holborn Invicta	19·8
5	Carter's Tipperary	28·1
6	Bangholm Hunsballe VI	27·9
7	Bangholm Obsgaard VI	26·5
8	Cooper's Bangholm	21·2
9	Purple-top White	26·2
10	Cooper's Elephant	26·1

Each yield is the average of nine weighings. Variety No. 4 (Carter's Invicta) is significantly lower in yield than the other varieties, with the exception of No. 8 (Cooper's Bangholm). The yield of the latter is significantly lower than those of varieties Nos. 5 and 6. There are no significant differences between the remainder.

GENERAL.

A number of miscellaneous experiments, largely of an observational nature, were conducted, and afforded considerable interest to the large number of farmers who visited the Area throughout the season.

Two field-days were held, and conspicuous success attended both, there being large and representative gatherings from the surrounding districts to view the work being carried out. There can be no question that Gore Experimental Area now plays a decided part in Southern agriculture.

Reference must again be made to the excellent manner in which the Area has been managed by Mr. J. Sleeman, Overseer, who has shown a keen appreciation of the necessity of careful experimentation, and has at all times ably carried out his duties.

Saving Pasture for Early-calving Cows.—The Fields Superintendent, Auckland, reports that the practice of early autumn phosphatic top-dressing on dairy-farms and the saving of some of the late autumn and early winter growth of grass for late winter feeding of early-calved cows proved quite satisfactory during the past winter, and that a wide extension of this method would be worth while. The erection of light two-wire fences across the saved grass-fields when feeding-off is successfully practised by some progressive farmers.

SEASONAL NOTES.

THE FARM.

Basic Facts of Controlled Grazing.

In early summer on most farms it is particularly desirable to take pains to prevent the whole or portions of fields under grazing from becoming too long and stemmy. One of the principal reasons why the development of long stemmy growth is ordinarily undesirable arises from the fact that there are vitally important differences between long stemmy growth and relatively short leafy growth as sources of nutriment for live-stock.

The basic facts are relatively simple. Herbage from pastures consists essentially of water and a residue which for convenience may be termed "dry matter." It is the nature of this dry matter which is of moment. The comparative feeding-values of leafy pasture growth and of stemmy growth, which characterizes herbage at or about the stage of cutting for hay, may be gauged from the following facts derived from the results of extensive work carried out in New Zealand and overseas: (1) The dry matter of samples from leafy pastures contains approximately twice as much phosphate and lime as is contained in dry matter from corresponding herbage at the hay stage; (2) the dry matter of leafy pasturage contains approximately two and a half times as much protein as occurs at the hay stage; (3) about 80 per cent. of the dry matter of leafy pasturage is digestible, whereas from 40 to 50 per cent. of the dry matter in stemmy pasturage is digestible.

The true significance of these three facts lies in the further fact that the rations of "wet" stock, such as cows or ewes in milk, are apt to fall short of requirements in respect to their mineral content, their protein content, and their digestibility. And the more productive the stock the greater is the likelihood that the feed will fail to meet its needs. Milk contains not only protein, but also lime and phosphates, all of which must be derived from corresponding substances in the pastures, and so the cow yielding 4 gallons of milk daily demands more of such substances in its ration than does the cow yielding 2 gallons. Similarly, other circumstances being equal, the ewe mothering two lambs requires more of those substances than the ewe with one lamb. To sum up, the more intense the production, the greater is the need for leafy pasturage, with its greater digestibility, greater content of mineral matter which is required for milk and bone formation, and greater content of protein which is required for milk and flesh formation.

A second reason why it is generally advisable to maintain pastures in a leafy and relatively short condition lies in the fact that it prolongs the season of their growth. Pastures which are allowed to become tall and stemmy in summer appear to exhaust themselves in the development of flower-heads, and certainly assume a resting condition during a considerable and critical portion of the producing season—that is, during late summer and early autumn. On the other hand, pastures which have not been allowed to develop flower-heads tend to continue the production of leafy herbage right through the season.

A third reason for avoiding stemmy growth on pastures lies in the fact that swards which are allowed to become tall tend to become undesirably open, and certain valuable species may be weakened by taller-growing competitive constituents of the sward.

Though the foregoing facts have been known for a considerable time, restatement of them seems to be justified, because the efforts made to maintain pastures in a leafy fresh condition are not as great or as widespread as is warranted.

Measures Fostering Controlled Grazing.

One of the most useful means of increasing the area of leafy fresh pasture on farms during summer is ensilage, the arrangements for which should have been made already. Even though good judgment has been used in deciding upon the area to be closed for silage, it is likely that there will be a tendency for portions of the fields kept under grazing to become tufty and stemmy. To counteract this tendency it is frequently advisable to top the pastures with a mower in November or early December. The longer necessary topping of pastures is delayed the poorer will be the results from it; in general, it should be done early enough to allow of the development of a fresh growth which would provide valuable feed from Christmas onwards. Topping should not leave the sward so short as to bring about injurious drying-out of the ground. Topping which involves close mowing of the vegetation would be especially undesirable just prior to the dry spell which is expected in the latter part of the summer in many districts.

At times, for the purpose of stimulating fresh leafy growth in the latter part of the summer, some of the pastures of a farm may with advantage be dressed with superphosphate in early summer. Such summer top-dressing is most effective in districts in which a good deal of rain falls in December and January, and it declines in effectiveness as the December-January rainfall decreases, until a point is reached when it is probably not worth doing.

Areas from which hay or silage have been saved generally respond profitably to a December dressing of superphosphate, which favours the vigorous production of fresh leafy feed available at a season when such feed is frequently in scant supply and therefore particularly valuable.

Fattening differs in Requirements from Butterfat Production.

From some of the foregoing statements it is to be concluded that certain important pasture-management practices are founded on or influenced by the differences between the feeding-value of immature leafy pasture growth and that of mature growth in which flower-stalks are prominent. In this connection certain points are not clear to all. For instance, it is known that on rich flats bullocks thrive on relatively coarse feed which is to be disparaged as feed for dairy cows; and as both the bullock and the dairy cow are fed for fat-production it may seem strange that the one type of feed does not serve equally well for both classes of animals. The explanation lies in the essential difference between the fattening of a beef animal and butterfat-production. That essential difference is found in the fact that stock-fattening involves principally the manufacture of fat, but butterfat-production involves not merely fat-manufacture, but is inseparable from the production of milk, which contains several important constituents in addition to its fat. The point of practical moment is that relatively coarse growth of a high-class sward, provided it has not been allowed to become markedly woody, contains a suitably balanced supply of the nutriment required for simple fat-production, but it contains a very badly balanced supply of the nutriment needed for milk-production as distinct from mere fat-production.

The fact that greater digestibility characterizes the more leafy growth also affects the position. The daily production of a good dairy cow calls for the extraction from its feed of much more material than does the daily increase in body weight of a fattening bullock. The relative feed-requirements of the good dairy cow and the bullock may be gauged from

the fact that a cow yielding 600 lb. of butterfat annually produces approximately as much human food as is contained in the complete carcasses of four steers weighing 1,250 lb. each. As the stomach capacity of the cow does not differ very much from that of a bullock, such facts indicate that the good cow must extract much more from a given quantity of its feed than need a bullock. This the cow can do only if its food is highly digestible and suitably balanced in its composition.

The crux of the matter is that body-fat production is an essentially different task from butterfat production, and that butterfat production is the more exacting and calls for more extensive utilization of nutriment.

Manipulation of Grazing Stock.

While ensilage, topping, and top-dressing may be made to serve as useful aids in maintaining the pastures in the vigorous leafy condition that should be the grazier's objective, they would be largely ineffective if not linked up with skilful manipulation of the grazier's principal tool—the grazing animal. While this matter cannot suitably be discussed fully in these notes, it is worth stating that on many farms much improved grazing management could be achieved with little or no alteration in their lay out, and hence with little or no additional expenditure. For detailed advice as to the methods to be adopted those interested should apply to the officer of the Fields Division in their district.

Haymaking.

In many cases, principally because of weather considerations, material for hay is cut when it is overmature, this resulting not only always in inferior hay of low digestibility, but also often in undesirable weakening and opening-up of the sward.

The only assured means of avoiding the influence of adverse weather when the material to be mown is at the right stage of maturity lies in the adoption of ensilage, and those who are not prepared to adopt this course should be prepared to employ all available means of saving good hay. Of these, cocking is one the value of which at times is unwisely ignored. Except in the recognized drier districts, it is doubtful if heavy crops can regularly be saved satisfactorily without the assistance of cocking. This method proves particularly useful in the saving of good-quality lucerne and clover hay. Indeed, generally in the making of such hay undue loss of the valuable leaves cannot be avoided, if drying is adequately effected, unless cocking is carried out. An indication of the value of cocking such hay crops is provided by the fact that the hay which features in the show prize-lists almost invariably is cocked.

Further advice regarding haymaking was given in these notes in the November, 1930, *Journal*, and may also be obtained from district officers of the Fields Division.

General Cropping Work.

Throughout most districts good farmers will be extremely busy with special cropping work during November and December.

Of the crops which it is customary to sow at this season the swede is of prime importance. Over wide areas it is known that successful results may be expected from sowing swedes in December at the rate of 10 oz. to 14 oz. per acre through every second coulter of an ordinary grain-drill. A fine firm seed-bed favours a good strike of swedes. When it is desired to mix the swede seed with the manure in sowing, care must be taken to avoid the serious injury to the seeds which results from bringing such seed in contact with readily soluble manures such as superphosphate, sulphate of ammonia, and potash salts. Of these, superphosphate is of most practical moment because, apart from the seed-injury it may cause if not used with

care, it is generally a most useful dressing for swedes. The injury caused by superphosphate can be entirely avoided by mixing the superphosphate with an equal weight of carbonate of lime (ground limestone) for about one week before sowing. The mixture should not be bagged as soon as it is made, because in bags it tends to set hard, whereas if left in heaps it is easily pulverized when it is to be used. To apply the normal quantity of phosphate this mixture must be used at double the usual rate. If there are difficulties in the using of lime in the manner suggested above, a mixture of super and one of the slower-acting phosphates in equal proportions may be used. The slower-acting phosphates include basic slag, and the island and African phosphates. In many parts outside the drier districts a mixture of superphosphate and bonedust gives excellent results with swedes.

Injury to seeds from the use of soluble manures occurs not only when seed is mixed with such manures, but also, though to a less yet nevertheless material extent, when seed and manure are distributed from separate boxes. Fuller information on this point is given elsewhere in this issue of the *Journal*.

One of the factors which have operated against the more general use of swedes has been club-root. Field evidence shows that a club-root attack is intensified by the use of superphosphate, while it is lessened by the use of lime or basic slag. Hence superphosphate alone should not be used with swedes when there is any reason for expecting an attack of club-root. Considerable and widely distributed field experience has shown that Herning swede is not only highly resistant (though not completely immune) to club-root, but also of good average cropping-power. Hence, if there is any evidence that an attack of club-root may be expected, the use of Herning swede is well warranted.

The sowing of soft turnips and rape is often successfully carried out at this season. With these crops, as with swedes, seed-injury is apt to occur if the seed is brought into contact with any considerable quantity of such manures as superphosphate and sulphate of ammonia.

Maize and millet to provide green fodder may often be sown successfully in December. Almost invariably these crops respond profitably to a dressing of superphosphate at the rate of 1 cwt. to 2 cwt. per acre, and unless the soil is highly fertile it is usually profitable to supplement the superphosphate with nitrogenous material such as blood-and-bone.

Intertillage and Thinning.

Inadequate cultivation is one of the most generally operating factors which limit crop yields. The value of the cultivation which produces a good seed-bed is generally known, even though at times, judging by what is practised, it seems to be overlooked. But the value of the cultivation after the sowing of the seed is not so generally recognized, and this type of cultivation is of especial moment at this season. Apart altogether from the weighty matter of weed-control, a growing crop in badly cultivated ground does not obtain the full benefit from money spent on good seeds and liberal use of suitable manures; further, if a dry spell of weather occurs, such a crop is apt to be reduced in yield because of inadequate moisture-supply which suitable surface cultivation would assist in avoiding. Hence intertillage of growing crops, sown in rows wide enough to allow of it, is as a rule highly desirable even though weeds are not prominent. This is especially true of the drier districts.

Often in December intertillage should be linked with thinning of crops sown in October or November. The thinning may usually be facilitated by prior hoeing along the rows. Thinning is most effective if done as soon as the seedlings are of sufficient size to allow of handling without undue difficulty. The weeding which accompanies such early thinning results in the destruction of the weed seedlings at their most vulnerable stage. In thinning mangels the soil should be drawn away from the seedlings rather than hoed up to them.

Miscellaneous.

Much valuable weed-control work can be done in midsummer, not only by destroying seedlings as mentioned, but also by taking measures against perennial weeds. This should be done when they are in the early flowering stage and while seed-development is still imperfect.

Spraying for control of potato-blight and kindred crop troubles is important summer work. The primary objective should be to make such spraying a preventive rather than a curative measure; but it should not be overlooked that spraying is of distinct value in checking the spread of blight which has gained a footing. Details of a modified improved method of preparing bordeaux mixture for potato-spraying were given in these notes in the November, 1930, *Journal*.

Care should be taken in good time to have all harvesting requisites available and in good working-order when required. The mower, the reaper-and-binder, and stacking equipment specially call for attention.

—R. P. Connell, Fields Division, Palmerston North.

Sheep-maggot Flies.

As the season of the year is at hand when sheep generally suffer from the ravages of the blow-fly pest, sheep-farmers are reminded that one of the most important methods of control is to destroy the normal breeding-ground—carcasses of animals—by burning or burying, and so lessen the prevalence of the flies. Crutching, and dipping with an arsenical powder dip are precautions which should also be taken to protect the flocks. As a means of control fly-traps are spoken very highly of in those districts where they are in use. It is estimated that tens of thousands of flies have been caught in a single trap in one day.

—A. T. P. Hubbard, Inspector of Stock, Masterton.

THE ORCHARD.

Disease and Pest Control.

In last month's notes, reference was made to the necessity for thoroughness in the application of sprays. Equal care is necessary in the weighing-out or measuring of the specifics to be used, otherwise disaster will result. An instance which came under notice in the last few days has rendered it advisable to warn growers against guessing the weights and measures required. A prominent grower, well above the average in intelligence, was using a tobacco-tin for measuring Black Leaf 40 for the control of leaf-hopper on apples. One pound (by weight) in his 80-gallon tank (1–800) was the quantity he considered he was using. When weighed it was found that he was placing only 12½ oz. in the spray-tank. Possibly by a change of tin or other unfortunate occurrence Black Leaf 40 was being used at 1 in over 1,000 instead of 1 in 800, and with practically no results on the hopper.

Pip Fruits.—The programme set out last month must be continued if a clean crop and healthy foliage is to be obtained. An application near Christmas is essential to tide the trees over the holiday season. For those growing stone fruit in addition to apples, such an application is necessary, so that it may not clash with the busy season of cherry, apricot, plum, and peach picking. If powdery mildew is getting a hold on the trees much assistance may be given by endeavouring to invigorate them with good cultivation, and, where possible, a thorough irrigation with a view to getting the trees moving again. The picking-off of mildewed points is practised by many good growers with good results. Unless ample protection is being given, red-mite will certainly become troublesome very shortly, and unless

checked will cause serious injury to the foliage. After a bad attack leaves cannot function properly, resulting in stunting of the tree and starvation of the buds to carry next year's crop. In addition, the fruit will be of inferior quality and of a poor dull colour. As with mildew, the trees must be pushed along by the conservation of moisture and heavy irrigation.

Stone Fruits.—Where brown-rot is anticipated continue the lime-sulphur treatment, adding a finely divided sulphur at 2 lb. to 5 lb. per 100 gallons. In some localities there is evidence of fairly severe attacks of green aphis on peaches, and it may be necessary to repeat the application of Black Leaf 40.

Leech on Cherry, Plum, and Young Pear Trees.—If the previous directions have been followed one more application of arsenate of lead, as soon as the crop of each variety has been picked, should keep this pest in check for the remainder of the season.

Earwigs.—If the surface of the tanglefoot banding used against this pest has become covered with dust or thistledown, rake it over or freshen it up by adding a little more.

Cultivation and Irrigation.

Orchards under clean cultivation should have the surface soil frequently stirred to prevent evaporation of moisture. An occasional heavier working, especially after rain or irrigation, will be an advantage. Those who have clover growing for subsequent ploughing-under should continue to cut it and let it lie on the ground to rot. Where cover-crops are to be sown this summer or autumn, growers should order their seed in ample time, so as to have it on hand when the opportunity offers for sowing. In addition to other well-known cover-crops, a fine stand of Scotch tares was noticed this past season with the roots literally covered with nitrogen-gathering nodules. Where water is available for irrigation, keep the soil moist, so as to retain good healthy foliage and swell out the fruit.

Thinning the Fruit.

Thinning should now be well under way, and where it is not completed must be looked upon as the most important operation in the orchard at the present time. Leaders of apple-trees should be assisted by the removal of all fruit near the tips.

Manuring.

There is considerable controversy as to the time of application of quick-acting nitrogenous manures in late spring or early summer. However, where the trees require a fillip an application, at the time or soon after these notes appear, of sulphate of ammonia at the rate of 1 lb. to 2 lb. per tree has proved of assistance in invigorating the trees, thereby helping the crop and the production of strong healthy buds for the following season.

Picking the Crops.

The picking of cherries, early peaches, and plums will have commenced before the next *Journal* is in the hands of growers. In that issue will appear advice in connection with the picking and handling of the season's crops generally. In the meantime it may be said that care in handling from the tree to the consumer, efficient grading and sizing, the keeping off the market of inferior fruit, and honest packing will go a long way towards ensuring to the grower a reasonable return for his year's labour and investment, even in these times of depression.

The making of cases and other preparations for the incoming harvest must be pushed along at any odd moments and on wet days.

—W. R. Lloyd Williams, Orchard Instructor, Alexandra.

Citrus Culture.

As indicated in last month's notes, growers should make every provision to safeguard their crops against attacks of verrucosis and grey scab. This can only be done by spraying with 4–4–40 bordeaux as occasion requires. It will be necessary to make several applications, as the blossoming extends over a fairly long period. The necessity is more apparent as each season comes round, and growers should leave nothing undone that will help them to produce high-grade fruit. There is possibly nothing which helps to disfigure and deteriorate the fruit of any tree more than disease. A careful watch should at all times be kept in order to carry out each seasonal operation as the year advances, and so long as this is done no single operation becomes a burden.

Cultivation should be given attention at this season of the year, in order to conserve moisture and assist the trees to function in a proper manner. Should the soil be of a stubborn character and have become very hard, watch for any showers that may occur, after which it should be fairly easy to reduce it to a fine tilth, which is important.

A limited amount of pinching of strong-growing shoots may be advisable in order to produce fruiting laterals, or it may be necessary to take out entirely a few shoots where overcrowding is likely to take place. Newly planted trees should receive particular attention, so that a good foundation will be laid upon which can be built up a strong and vigorous tree, which in future years will be of value in producing heavy and continuous crops of fruit.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Control of Insect Vermin.

At this season of the year, when hot weather conditions may be expected, it is essential to fight insect vermin, for it is now that these natural enemies of poultry are making their appearance. The best method of combating them is to prevent them getting a foothold, if possible, and the sooner steps are taken in this direction the more effectively will the spread of the pest be checked. To prevent the presence of red-mite, fleas, &c., the quarters should be thoroughly cleaned, and this should be followed by a good spraying with a reliable disinfectant. The wise poultry-keeper never allows red-mite to make its appearance, realizing that this parasite hides in cracks and crevices which provide a means for the mite getting beyond the reach of any spray.

Many spraying-materials for red-mite have been condemned as useless, whereas the real reason for their failure has been that the spray has never reached the hiding-places of these night marauders, which wait until the spraying mixture has dried and then get to their blood-sucking work. Where a house becomes badly infested with red-mite it is a good plan to give the outside of the walls a spraying as well as the interior of the house. In this way any insects that find their way outside in an endeavour to get away from the spraying-material can be destroyed, and so prevented from returning to the interior of the house when the spraying-material has lost its effect.

Regarding the vermin that are found on the body of the fowl, these will not be overcome by any spraying process, but powdering the birds may have the desired result to a certain extent where only a small flock is kept; this means, however, is out of the question on a large plant. When a bird is seen to be busy pecking among its feathers the presence of vermin may be regarded as certain. If body-lice are very prevalent in a flock, and the birds are at all confined, all the conditions are present for the

formation of the bad habit of feather-pulling. Probably in 99 per cent. of cases feather-pulling has been due to irritation caused by heavy infestation of body-lice.

The value of Black Leaf 40 (a by-product of tobacco) for freeing fowls of any lice that may be present cannot be overestimated. A small hole should be made in two opposite corners of a small tin containing the preparation and the tin then passed along each perch, leaving a thin line of the liquid on the perch. This should be done at dusk just before the birds go to roost. For the treatment to be really effective it is important that all birds should go or be placed on the perches and not allowed to roost in odd corners of the house. If there is much dust on the perch the liquid is apt to run off and become wasted, and to prevent this it is a good plan to first rub the perches over with a damp cloth. If this is done, the liquid can be more easily applied to the centre of the perch, and the risk of wastage will be reduced to a minimum. Birds that are in broody-coops, &c., may be freed from vermin by dipping a feather into the liquid and drawing it between the breast feathers.

The Surplus Cockerels.

In view of the present cost of foodstuffs I would urge strongly the necessity for marketing all cockerels not required for future breeding purposes, as early as their condition warrants. There is no greater drain on the profits of poultry plants than the keeping of cockerels beyond a marketing stage—say, from four and a half to five months old, or before the adult plumage commences to appear, as it is impossible for a bird to produce feathers and flesh at the same time. It is surprising the amount of flesh a chicken will put on prior to producing its second feathers, providing it has not received a check and is fed well and maintained in a healthy thriving state. It is equally surprising how rapidly birds will lose condition when the second feathers commence to appear. The check in development of flesh with the appearance of the new covering is due not so much to the sudden and new demand on the bird's constitution as to the fact that at this age birds commence to indicate the natural propensities of development, even when running by themselves, by sparring and fighting, and generally taking considerable exercise, especially with the lighter breeds, and all this is against flesh-production.

If the birds, therefore, are to show a profit, especially the lighter breeds, they should be marketed before the appearance of the adult plumage. If allowed to go beyond this stage, and it is necessary to put the condition on to the matured frames, the cost of production will easily prove too great to leave any profit, even when a reasonable price has been secured. It is quite probable that more money will be secured for a prime bird at five months old than will be obtained for it if marketed in good condition at seven months. At the former age the frame is covered with delicate flesh, while at the latter stage the flesh is "staggy." One fatted bird is worth more than two unfatted, even in markets such as ours, where very few choice table birds reach the market.

When priming cockerels it is a good plan to limit the size of the run and so curtail the means of exercise. Under these conditions, and if given ample food, the birds will rapidly produce flesh. Do not try to prime cockerels on inferior or damaged food. If they are to rapidly lay on flesh the food should be sound and fed with a free hand. Only soft food should be given; hard grains are apt to bring on digestive troubles when the birds are confined to a limited space. A suitable mash may be made from two parts of bran and one part each of finely ground wheat-meal and maize-meal, the whole being moistened with skim-milk or soup and mixed to a crumbly mass. Succulent green material can be fed in abundance, but separately, and where skim-milk is available it may be given in large quantities to

drink. Those who have prime cockerels for disposal should endeavour to have them sold by weight. For such birds to be sold by the pair is an unsatisfactory system both to the producer and the consumer. When selling birds by weight every extra ounce of flesh means increased profits to the producer and greater satisfaction to the consumer.

Web-marking the Young Stock.

The importance of marking the young stock as a future guide when separating the birds according to their age is not appreciated by the average poultry-keeper as much as it should be. All birds hatched this season should be properly marked without delay. It is of no use trusting to the eye in this connection. Many a good pullet has been sent to market simply because a little scaly-leg has led the owner to think it was an old bird. The chicks can be marked immediately they are hatched. Where no system of marking is employed confusion and annoyance is often caused in the vain endeavour to pick out birds of different ages during the culling season. A simple toe-punch for making a hole in the web of the foot can be purchased for about 2s. There are fully fifteen distinct marks which can be employed, using the two feet, for the purpose of identification of age and strain.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

Simple Methods for Requeening.

By this time the beekeeper should be able to decide which of his queens are fit to carry on through the season, and which should be destroyed and replaced by new ones. During the swarming season it is a simple matter to obtain good ripe queen-cells for requeening purposes. A few nucleus hives are a valuable asset in any apiary, and may be utilized throughout the summer for the purpose of hatching and mating relays of young queens. In addition to the employment of queen-cells produced under the swarming impulse (and such cells are usually of the best quality), there are several methods of artificial queen-raising in practice among commercial beekeepers. Most of these are described in any text-book, but are sometimes regarded as too intricate for the average man.

A simple method, and one frequently very successful if only a small number of cells is required at once, consists in raising several frames of eggs and very young brood above an excluder, confining the queen to the bottom story. At the end of ten days or so there should be several good queen-cells on the frames above the excluder, ready to transfer to nucleus colonies. These cells should be carefully cut from the combs without any jarring or shaking, and grafted on to combs in the nucleus hives. On no account should the queen-cells be removed before the tenth day. They would really be better left in the parent hive for a longer period, except for the fact that the bees may have raised them from young larvæ, in which case they will be due to hatch on the eleventh or twelfth day. This method is even more likely to ensure success if the combs containing eggs, &c., are placed in the third story with a super of sheets of foundation or empty combs between them and the brood-chamber. It must be borne in mind that no dequeening is required by this method.

Another simple method, and one more easily controlled by the beekeeper, consists in placing a frame of eggs horizontally over the frames in the brood-chamber. This is best arranged for by placing an empty worker-comb in a strong colony and marking the date on the frame. As soon as the queen has laid in the comb the colony which is to be utilized for queen-raising purposes must be dequeened, and it is best at the time

to remove all unsealed brood. This will ensure that all queen-cells will be raised on the specially prepared frame of eggs. If every second and third row of cells is pared down to the midrib, and only one in four of the cells in the remaining rows allowed to contain an egg, a greater number of queen-cells will probably be procured. However, the frame will usually be found quite satisfactory just as it comes from the hive, without any paring or cutting. An empty frame must be procured and laid on top of the brood-chamber. On this the frame of eggs is laid, and the whole covered with two or three mats. An empty super must be placed on the hive, so that the frame of eggs will not be crushed when the roof is put on. The bees will draw the queen-cells downward, the empty frame allowing room for them to be developed to their full length. If only eggs are used, as suggested, the queen-cells may be safely left on the hives for thirteen or fourteen days after the introduction of the frame of eggs, by which time they will be ready for the nuclei. As soon as the young queens in the nuclei have laid a fair number of eggs they should be removed to replace a failing queen, and their places filled by more ripe queen-cells, until a sufficient number of young queens have been produced to renew the stocks in the apiary.

Forming Nuclei.

With the approach of the main honey-flow and the prospect of more settled weather the beekeeper can turn his attention to the question of forming nuclei, either with an eye to artificial increase or for queen-raising purposes. Whatever the object for which they are produced, the simplest method of forming nuclei is as follows: From the strongest colonies in the apiary take combs of sealed brood with adhering bees. Place two of these combs in each nucleus hive, together with one comb of honey and an empty comb. It is as well, if the size of the hive will permit, to add a feeder. Close the entrance of the nucleus hive by tacking over it a piece of perforated zinc or wire cloth, and place the newly formed colony in a cool place for twenty-four hours. At the end of this time the hive may be placed on its permanent stand and the entrance opened. Some of the field-bees will return to the parent hives, but in the meantime much of the sealed brood will have hatched, and thus the absconders will hardly be missed. The small colony can at any time be given a ripe queen-cell, and under favourable weather conditions will soon possess a laying queen.

Nuclei can be built from one or two strong colonies, each of which should produce four or five small colonies; or several hives in the apiary may each be robbed of a frame of brood, thus providing increase while leaving the full colonies practically undiminished. When the young queen commences laying in a nucleus hive she should be left in possession until she has filled two frames with eggs, when she may be removed and given to a colony which requires requeening. The nucleus should at the same time be supplied with a ripe queen-cell, and the process repeated as long as young queens are required.

Finding Black Queens.

It is a very difficult matter, even for experienced beekeepers, to find a Black queen in a thickly populated colony by the usual method of looking over the frames. Much time and labour may be saved by adopting the sifting method. To do this tack a queen-excluder on the bottom of an empty half-super; then nail on the excluder a piece of board about 4 in. wide and the length of the hive, so that its edge is flush with the side of the half-super. Now remove from the bottom-board the hive containing the queen to be found, placing it to one side. Put an empty super in its place on the stand, then over it the sieve or super with excluder. This should be placed so that the board on the bottom overlaps the hive below by about 4 in., which will leave a gap at the opposite side in which to replace

the frames. Now place the hive over the sieve, lift out each frame with the adhering bees, starting from the nearest side, and quickly give each frame a sharp shake over the hive on the sieve so as to dislodge the bees. As each frame is done, place it in the hive below, sliding it along under the excluder; it will be gradually pushed along until it occupies its former position in the hive. When all have been done the remaining bees in the now empty hive may be dumped into the sieve. The bees will soon find their way down to the brood below, leaving the queen and the drones above the excluder, as they cannot get through the small holes. A little smoke will hasten the descent of the worker-bees. The queen can then be found trying to get through to the brood below.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Attention to Small-fruits.

So soon as a crop of small fruit is harvested there is a general tendency to neglect the plants for a while. This is probably one of the biggest mistakes we make in this class of cropping. After the strain of cropping the plants should have every attention which will free them from disease and enable them to make the most of the autumn weather—to ripen young wood and fruit spurs and set strong buds that will prove fertile another season.

Suckers about the base of gooseberry-bushes, and strong water-shoots crowding the centre, should be carefully removed completely. This will divert the energies of the plant into fruitful channels, and give air and light, which are so beneficial, to the young growth.

In many instances it is advisable to cut out the wood that has borne the crop in black currants, for a somewhat similar reason. The benefit is all the greater if the plants are inclined to be weak or diseased. After pruning, the cleansing and protecting chemical spray will be more effectual, and the new wood which should bear next season will be strengthened. The same statement, but with more emphasis, applies to raspberry and loganberry crops. They are more subject to disease, and by cutting away the old canes and vines at the ground-level and burning them, so soon as they have finished cropping, most of the infected wood will be destroyed.

It will be noticed that all the plants above mentioned carry the fruit crop chiefly on the young wood only; therefore, as soon as it has borne and ceases to be of use, it is removed, with benefit to the new wood formed elsewhere on the plants meanwhile. In the case of the red currant we are dealing with a plant which crops on a different plan. The fruit is carried on spurs which are comparatively permanent, and remain fruitful if they are given light and air, and are not overgrown by strong laterals and suckers. Such superfluous growths should be removed now. While in the case of the black currant the suckers are fruitful, in the case of the red-currant bushes they are detrimental and should be entirely suppressed. Also strong young shoots about the centre and any that unduly crowd the framework should be removed. The lateral growth on the main framework of the bushes may now be shortened with a view to encouraging the formation of fruit spurs.

That vigorous and handsome vine which bears an interesting and useful fruit—the Chinese gooseberry (*Actinidia chinensis*)—would also be benefited by stopping lateral growth and removing superfluous shoots at the present time.

Such treatment as that above described is generally referred to as summer pruning, and the general effect is to increase the crop.

Where strawberry-beds are cropped only for the one season they should be cultivated immediately after cropping, and sown down with a cover-crop to be turned under and rotted before planting again. Or, if broccoli or cauliflower, &c., is to follow, with a little cultivation the conditions are ideal. Where the strawberry-beds are grown on for another year they should be cleaned up after fruiting, removing or burning the litter used for bedding down the plants, and any accumulation of dead leaves and rubbish. The suppression of runners and weeds should be maintained throughout the autumn, so that clean ground and strong plants will be available in the spring in preparation for another crop.

Another attention necessary, when those mentioned have been given, is spraying to prevent the spread of fungus diseases and destroy insect pests. Most of the old diseased wood having been removed and burnt, the young wood remaining will be comparatively clean, and the plants sufficiently open to readily permit the spraying to be done effectually by covering all parts. The principal spray used will usually be bordeaux mixture for preventing the spread of fungus disease, with arsenate of lead added to destroy caterpillars. In doing this the main economy is not so much in doing it quickly as in doing it well. If the bordeaux is made as is usually described it will take a little longer, but the adhesion will be exceptional, which means that the protection from fungus attack will be much more lasting.

Tomato-culture.

Harvesting of the choice fruit grown under glass is at the peak during the month of December. If the crop is clean, and the feeding has been well balanced, the management at this stage should not present any difficulties, provided the ventilation of the house receives regular attention; otherwise, by receiving too much or too little, the crop may be brought to a standstill very quickly. In most instances the ridge ventilators should be open now to some extent day and night, except when fumigating the house.

It was at this season last year that the outdoor crop was attacked by the tomato-moth (*Gnorimoschema melanoplintha*), with in many instances very serious results. The base of the plants especially should be kept well covered with the spray mixture described in these notes last month. The fruit will be very small at the present time, and the plants can be sprayed thoroughly without causing any inconvenient discoloration of the fruit—such discoloration makes it desirable to stop spraying, so far as possible, as the fruit approaches maturity, or extra cost may be incurred by the necessity of washing or in some other way cleaning the fruit after picking.

Cultivation should be continued for the purpose of suppressing weeds, &c.; but great care is necessary to avoid disturbing the fine soft roots which rise very close to the surface of the soil. Great damage is often done by deep cultivation at the present stage of growth, the main effects of which are a check in the growth which permanently dwarfs the plants, and general debility which will still further reduce the crop. The removal of young lateral growth arising in the axils of the leaves, and tying the vines to the stakes or wire trellis at intervals of about a foot, are the other routine attentions required at the present time in the outside crop.

For filling the seedling-boxes for the succeeding crop, a clean sweet loam will be needed in the late winter and early spring of next year. This is best obtained by stripping sods from a rich pasture or other land that has not been cropped for some time, and stacking them neatly in a compact heap to rot. If the heap is kept moist and free of weeds this will be accomplished all the better. Two years is not too long for the preparation of potting soil, and where arrangements for the supplies for next season have not been made they should be commenced at once.

Vegetable Crops.

To destroy weeds, retain moisture in the soil, and increase oxidization of the soil particles, use the hoe frequently, but not deep enough to injure the fibrous roots of the plants.

See that vegetable marrows do not suffer through want of water; they require plenty. Cut the fruit so soon as it is of a handy size; small, tender immature fruits are in demand. Other gourds also enjoy moist conditions when the drainage is good.

As crops of early potatoes, peas, &c., are cleared away, prepare the ground at once for setting out plants of savoy cabbage, cauliflower, broccoli, brussels sprouts, celery, leeks, for harvesting in winter. Choose showery weather for this, or plant in the afternoon and water the plants in.

Most of these crops require close attention to protect them from pests and disease. Green fly is the worst pest of the cabbage family now, as it is apt to destroy the terminal bud, which is vital. A pinch of tobacco-dust will protect that part of the plant until it commences to make vigorous growth when autumn rains bring relief.

Celery-spot (*Septoria Petroselini*) is now a common and serious disease of celery crops. Commencing as small spots that spread and coalesce, it forms withered patches of irregular shape, on which black pinhead fruiting bodies of the fungus develop. This disease may be prevented by spraying bordeaux at regular intervals. Rotational cropping should also be practised.

Make a further sowing of globe beet, shorthorn carrots, peas, and dwarf beans; also lettuce where it may be left to mature without transplanting.

The Homestead Garden.

We are approaching once again the most suitable time of the year for making gardens—the autumn. Where gardens have to be made, extended, or altered, the proposals should be planned to scale on paper now. People's ideas on this subject are generally quite good, but they often do not materialize because they are not fully communicated to those doing the work. Or, as perhaps happens more often, the good ideas are vague and time is not taken to define them clearly before commencing the work. This naturally is a mistake. One may be ready to change a plan in some respect if it is afterwards shown to be desirable; but it is most necessary to have one, very definitely, before the work is commenced. Not only should formation be planned, but planting also. The usual high mortality in new plantations and shubberies would be lower and the results more effective if this were done. If the work is arranged so that lawns are sown down in February, and trees and shrubs planted in May, it would generally be best.

Young trees and shrubs lately planted often suffer badly from dry conditions during summer. The roots are severely restricted by removal, and they cannot obtain the moisture required for growth. Moisture-loving plants, especially rhododendrons, suffer severely and become stunted in growth. Where this danger threatens, a mulch of fermented vegetation or stable manure should be spread over the surface of the ground to keep it moist and moderate extreme temperatures. In some cases even watering may be necessary. On light and sandy lands such trees are often greatly benefited by this attention now.

—*W. C. Hyde, Horticulturist, Wellington.*

Horses eating Silage.—During the past winter an Otago settler brought his horses on to eating silage by mixing oaten chaff with it. They soon began to take the silage alone.

FERTILIZER IMPORTATIONS: SEPTEMBER QUARTER.

FOLLOWING are particulars of importations of fertilizers into New Zealand for the quarter ended 30th September, 1931 :—

Sulphate of ammonia : United Kingdom, 2,020 tons. *Basic slag :* United Kingdom, 523 tons; Belgium, 650 tons; Netherlands, 300 tons. *Bonedust :* India, 100 tons. *Guano :* United Kingdom, 15 tons; Seychelles Islands, 3,642 tons; Madagascar, 2,428 tons. *Rock phosphates :* Ocean Island, 5,206 tons; Nauru Island, 27,988 tons. *Phosphates (other) :* United Kingdom, 140 tons; Belgium, 850 tons. *Kainit :* France, 25 tons; Germany, 25 tons; Poland, 45 tons. *Sulphate of potash :* France, 95 tons; Germany, 102 tons. *Other potash manures :* Belgium, 25 tons; France, 693 tons; Germany, 311 tons; Poland, 291 tons. *Sulphate of iron :* Australia, 3 tons. *Other fertilizers :* United Kingdom, 26 cwt.; Germany, 28 cwt.

ESTIMATED AREAS UNDER CEREALS AND POTATOES.

THE following estimates of the areas under wheat, oats, and barley in the Dominion for the current season were issued by the Government Statistician at date 27th October, the figures being based on a card census: Wheat, 276,000 acres; oats, 329,000 acres; barley, 24,000 acres. The corresponding interim figures for the preceding season (1930–31) were 252,558 acres of wheat, 367,042 acres of oats, and 30,716 acres of barley.

Also from a card census and at same date the Statistician estimates this season's area under potatoes as 22,500 acres. The corresponding interim figures for the 1930-31 season were 28,484 acres. Only holdings of 1 acre and over outside borough boundaries are covered by these figures.

Seven-year-old silage fed out to stock on the Van Asch Estate, Craggy Range, Hawke's Bay, last winter was found to be of good quality and in parts still warm.

TRENCH SILO IN PROCESS OF FILLING.

WEATHER RECORDS: OCTOBER, 1931.

Dominion Meteorological Office.

IN marked contrast to the cold wintry type of weather of the preceding period, October, for the most part, proved a very pleasant spring month, notable features of which were the predominance of northerly winds, warm temperatures, and fairly abundant sunshine.

For the past two years the mean monthly temperatures have been almost consistently below normal, while last year's was one of the coldest Octobers experienced since records have been kept. During the present October, however, most districts recorded above normal temperatures. The coldest day generally was the 24th, when a bitter southerly blew, accompanied by hail and snow showers in many parts of the South Island and in the central and high country of the North Island. During the night a damaging frost occurred in some districts, this being the only occasion on which a severe frost was registered.

Rainfall.—Practically the whole of the Dominion had less than the normal rainfall, the deficiency being greatest in the North Island and most pronounced in Hawke's Bay Province. Central Hawke's Bay experienced extremely dry weather, and a good soaking rain would be especially welcome in that area.

Pressure Systems.—Anticyclones were frequent during the month, and, although their centres, as is usual at this season, moved rather far north, they were responsible for generally fine weather from the 3rd to the 4th, the 14th to the 19th, and from the 26th to the 31st.

Depressions were mainly cyclonic in form, but they were not frequent, and were usually of slight extent and intensity. One such passed through Cook Strait on the night of the 1st and accounted for fairly general rain during the night, while on the 2nd some heavy falls occurred in the neighbourhood of Cook Strait, with a strong southerly wind on the latter date.

On the 8th another depression of a similar type, located north of the Bay of Plenty, was responsible for some heavy rain in the latter district and elsewhere in Auckland Province. In the afternoon of this day a severe thunderstorm accompanied by heavy hail broke over Auckland City.

Between the 10th and the 13th a series of very intense westerly depressions moved over the Dominion, and strong and squally north-west to west winds prevailed. Rainfall was confined chiefly to districts with a westerly aspect, the eastern provinces at this time experiencing very warm dry conditions. During this period the north-westerly winds were at times particularly violent in the latter districts. A severe gale on the 10th did a considerable amount of damage to plantations on the Canterbury Plains and the electric power service was severely affected, numerous poles being brought down. Torrential rain in the watersheds caused floods in many of the West Coast and Canterbury rivers. A flood in the Waimakariri River was described as the worst since 1927, its waters inundating some of the low-lying land on the plain. By the 14th the last of this series of depressions had crossed the Dominion and a change to south-westerly winds had set in, although practically no rain accompanied the change in the eastern districts.

On the night of the 19th another intense depression moved on to the Dominion a centre apparently crossing Otago. On the morning of the 20th the latter caused a violent northerly gale in parts of Otago. At Dunedin the gale was the worst experienced for many years, and resulted in extensive damage to buildings, fences, and gardens. The effects of this storm, but to a lesser extent, were also felt in South Canterbury.

The last storm of the month was brought about by a small but rather intense cyclone which developed off the east coast of the South Island on the afternoon of the 23rd. During the night conditions became rapidly unsettled and, as previously mentioned, a severe cold southerly prevailed on the 24th, with general rain, and in many places snow and hail showers were experienced. The worst effects of the disturbance, however, were of brief duration.

RAINFALL FOR OCTOBER, 1931, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	1·54	11	0·44	5·98
2	Russell	1·68	6	0·70	4·44
3	Whangarei	2·56	11	1·05	5·04
4	Auckland	2·15	13	0·68	3·71
5	Hamilton	1·97	9	0·74	4·77
6	Rotorua	4·71	7	2·41	5·40
7	Kawhia	3·14	12	0·88	5·24
8	New Plymouth	2·58	15	1·20	5·62
9	Riversdale, Inglewood ..	5·89	14	1·80	10·54
10	Whangamomona	5·47	9	1·93	8·64
11	Eltham	3·65	14	1·32	5·00
12	Tairua	2·36	8	1·08	5·99
13	Tauranga	2·85	8	1·76	5·44
14	Maraehako Station, Opotiki	2·36	8	1·38	5·51
15	Gisborne	0·27	2	0·25	2·77
16	Taupo	2·44	12	0·95	4·46
17	Napier	0·64	7	0·26	2·28
18	Hastings	1·73	11	1·03	2·32
19	Taihape	1·37	11	0·46	3·86
20	Masterton	1·62	4	1·13	3·36
21	Patea	2·77	12	0·75	4·29
22	Wanganui	1·39	9	0·60	3·48
23	Foxton	1·30	8	0·62	3·11
24	Wellington	2·80	9	1·51	3·41
	South Island.				
25	Westport	7·57	16	2·08	8·70
26	Greymouth	9·91	19	1·81	10·32
27	Hokitika	11·20	20	3·28	11·81
28	Ross	14·67	14	3·39	14·69
29	Arthur's Pass	18·09	11	4·20	20·93
30	Okuru	12·20	19	2·67	15·76
31	Collingwood	4·21	10	1·29	10·68
32	Nelson	2·75	6	1·53	3·54
33	Spring Creek, Blenheim ..	1·11	7	0·92	2·63
34	Tophouse*	..	..	..	..
35	Hanmer Springs	2·48	9	1·09	3·60
36	Highfield, Waiau	1·30	5	0·78	2·81
37	Gore Bay	1·46	4	1·05	2·20
38	Christchurch	1·66	5	0·74	1·70
39	Timaru	1·30	6	0·74	1·95
40	Lambrook Station, Fairlie ..	1·84	6	1·08	2·03
41	Benmore Station, Clearburn	2·08	9	1·02	2·15
42	Oamaru	0·89	6	0·61	1·74
43	Queenstown	3·74	14	1·10	3·45
44	Clyde	1·54	7	0·64	1·62
45	Dunedin	1·45	12	0·45	3·16
46	Wendon	1·70	9	0·36	2·81
47	Gore	..	..	..	3·28
48	Invercargill	2·24	16	0·46	4·56
49	Puysegur Point	7·78	23	1·26	8·13
50	Half-moon Bay	4·99	21	0·86	5·37

* Tophouse Post Office, with observing station, closed.

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1931.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams (entered in flock-book)	1,411	1,249	3,902	689	3,406	4,344	15,001
Other rams	49,458	98,913	93,900	19,481	88,196	97,049	446,997
Wethers	478,659	642,930	741,815	263,148	554,312	748,688	3,429,552
Breeding-ewes	1,904,883	3,669,235	3,672,887	796,009	3,657,769	3,907,946	17,608,729
Dry ewes	102,551	343,643	196,294	84,312	229,889	254,025	1,210,714
Lambs	774,444	1,668,886	1,441,816	333,288	1,174,159	1,688,930	7,081,523
Totals, 1931 ..	3,311,406	6,424,856	6,150,614	1,496,927	5,707,731	6,700,982	29,792,516
Totals, 1930 ..	3,325,272	6,937,555	6,273,086	1,526,516	6,052,042	6,726,816	30,841,287

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1922–31.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,073	23,081,439
1924	332,814	179,533	9,727	132,137	654,211	2,807,832	12,896,561	1,036,723	6,381,249	23,775,776
1925	355,579	184,744	7,867	131,485	679,675	3,063,663	13,530,479	875,899	6,398,239	24,547,955
1926	370,535	192,055	10,053	138,526	711,169	3,212,435	13,756,197	1,069,682	6,155,510	24,904,993
1927	388,274	199,219	8,644	144,897	741,034	3,074,974	14,632,511	823,047	6,377,450	25,649,016
1928	396,351	205,720	7,347	145,969	755,387	3,024,647	15,328,331	861,780	7,163,653	27,133,810
1929	422,331	219,802	7,203	156,526	805,862	3,289,135	16,388,353	875,495	7,692,537	29,051,382
1930	448,617	244,480	7,884	174,862	875,843	3,367,916	17,319,695	1,069,788	8,208,045	30,841,287
1931	461,998	238,281	8,081	169,879	878,239	3,429,552	17,370,448	1,202,633	6,911,644	29,792,516

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1931).

Breed.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in flock-book)—									
Merino	..	5	..	5	8,261	12,547	6,724	27,532	27,537
Lincoln	657	1,236	7,050	8,943	382	223	52	657	9,600
Romney	20,987	19,030	87,013	127,030	9,007	6,913	54,962	70,882	197,912
Border Leicester	698	..	218	916	320	13,657	10,633	24,610	25,526
English Leicester	1,569	224	31	1,824	1,897	22,418	899	25,214	27,038
Shropshire	284	..	223	507	84	2,311	1,084	3,479	3,986
Southdown	7,458	13,083	39,784	60,325	1,871	20,500	3,931	26,302	86,627
Corriedale	80	61	706	847	972	33,188	10,424	44,584	45,431
Ryeland	1,037	602	618	2,257	47	1,466	282	1,795	4,052
Other breeds	65	3	266	294	1,072	2,167	..	3,239	3,533
Totals	32,835	34,244	135,869	202,948	23,913	115,390	88,991	228,294	431,242
Sheep of a distinctive breed, but not entered in flock-book—									
Merino	14,738	16,186	12,358	43,282	211,663	496,409	379,351	1,087,423	1,130,705
Lincoln	7,123	31,150	10,241	48,514	2,540	10,416	3,763	16,719	65,233
Romney	519,503	1,494,507	1,175,040	3,189,050	143,757	104,834	414,441	663,032	3,852,082
Border Leicester	10,264	784	487	11,535	1,286	29,242	28,184	58,712	70,247
English Leicester	3,523	890	476	4,889	6,325	35,142	3,199	44,666	49,555
Shropshire	2,369	226	402	2,997	1,400	6,264	5,244	12,908	15,905
Southdown	20,772	28,949	64,266	113,987	2,179	26,423	6,654	35,256	149,243
Corriedale	5,611	2,052	18,187	25,850	39,254	724,276	495,666	1,259,196	1,285,046
Half-bred	23,650	12,743	40,667	77,060	346,425	950,997	513,918	1,811,340	1,888,400
Ryeland	574	318	215	1,107	71	1,705	341	2,117	3,224
Other breeds	1,401	561	1,456	3,418	95	564	246	905	4,323
Totals	609,528	1,588,366	1,323,795	3,521,689	754,995	2,386,272	1,851,007	4,992,274	8,513,963
Crossbreds and others not otherwise enumerated	2,669,043	4,802,246	4,690,950	12,162,239	718,019	3,206,069	4,760,984	8,685,072	20,847,311
Grand totals	3,311,406	6,424,856	6,150,614	15,886,876	1,496,927	5,707,731	6,700,982	13,905,640	29,792,516

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith Letters should be addressed to the Editor.

DOG WITH SORE FEET.

A. MORTENSEN, Ngatamiro :—

I have a sheep-dog about two years old which about a month ago got a sore foot. The whole foot was swollen, especially the toes; it was quite red and raw in places under the foot and between the toes. After a few days one of the other feet became affected, and now they are all bad, so that the dog can hardly walk at all. I have been giving Epsom salts and sulphur, and bathing the feet with camfosa, but it seems to do no good. I shall be pleased if you will let me know how to treat him.

The Live-stock Division :—

The trouble may be what is known as interdigital eczema, or it may be a case of sore feet following overwork and a low constitution. If there is any suppuration the hair must be clipped closely and the feet bathed in a weak antiseptic solution of Condy's crystals in water. Rest and cleanliness are two most important factors in assisting recovery. If the swollen areas are dry, olive-oil or boracic ointment should be applied at frequent intervals. On the other hand, if the affected areas are continually moist and weeping, a dry dusting-powder composed of equal parts of starch and boracic acid should be applied at regular intervals. A dry comfortable bed of straw should be provided, and a nourishing diet. Internal medication in this trouble is not of much assistance. It may be found necessary to muzzle the dog to prevent excessive licking of the affected feet.

EARWIGS IN THE GARDEN.

"APRICOTS," Washdyke, Timaru :—

Would you please tell me how to prevent earwigs from eating into apricots when the fruit is ripening. What method of control would you advise?

The Horticulture Division :—

Earwigs often do a great deal of damage in the garden by eating flowers and fruit. In some parts of the country they are a serious pest, and a satisfactory means of control has not yet been discovered. The method giving the most satisfaction is using the following bait, which should be laid in the vicinity of places where the insects may be expected to congregate: Bran, 6 lb.; sodium fluoride, 6 oz.; treacle, 2 lb.; glycerine, 2½ oz.; water, 3 quarts. Dissolve the sodium fluoride in the water; add the treacle and mix in the bran, then add the glycerine. Spread the bait in small heaps in and about the garden. Renew applications after rain or when the bran becomes dry.

RIPENING OF GRAVENSTEIN APPLE CROP.

"GRAVENSTEIN," Huapai :—

Is there any special method whereby growth of Gravenstein apples may be quickened to take advantage of early market for cookers?

The Horticulture Division :—

A crop of Gravenstein apples will ripen earlier in one district than another owing to a warmer soil and climate, but we very much doubt if anything could be done to hasten the ripening of this crop to an appreciable extent in your orchard. There may be some local feature, such as a drainage disability, the removal of which may have the desired effect. Your best course would be to discuss the point with the district Orchard Instructor when he is visiting your locality.

RIDDING A LAWN OF WEEDS.

"GARDENER," Auckland :—

Can you tell me any method of getting a lawn rid of daises, except by individual weeding or digging up the whole lawn ?

The Horticulture Division :—

The subject of ridding lawns of weeds, including daisies, was fully dealt with in an article in the *Journal* for June last. The experiments carried out showed that an efficient and economical method is to apply as a fine spray a solution of arsenate of soda (arsenic pentoxide, As_2O_5), 1-80—that is, 1 lb. arsenate of soda to 8 gallons water. First dissolve the material in a gallon of cold water, and then dilute to the required strength. One gallon of the solution is sufficient for wetting 20 square yards of turf. Applied evenly it will destroy the weeds, but the grass, while it will brown at first, will make a quick recovery. The present time will be suitable for the treatment. Arsenate of soda is poisonous, but is safe if used with reasonable care.

BARLEY FOR POULTRY.—RAISING OF PIGS ON LUCERNE AREA.

"INQUIRER," Seddon :—

(1) Can barley be used to advantage for poultry in place of maize when feeding a mixed night ration during the colder weather ?

(2) Approximately what area of ground is required to graze, say, ten sows and their progeny in a proper manner when properly subdivided—the grazing being good pasture lucerne ?

The Live-stock Division :—

(1) Barley may be used to advantage instead of maize in a grain mixture for fowls during the cold season of the year, but the difference in cost of the two cereals is a matter that must be taken into consideration. Fowls usually prefer hulled barley to that which has not had the husks removed.

(2) Provided the winter food has been arranged for, which should be by means of 1 acre of mangels, and the roots supplemented with ½ lb. meat-meal per pig per day, the area of lucerne sufficient to accommodate ten sows and their progeny for the rest of the year would be about 5 acres, which should be subdivided into ten half-acre sections. The lucerne would also require to be supplemented with meat-meal, varying from ½ lb. to 1 lb. per day for sows, and from 2 oz. to ½ lb. for the young pigs, according to age, the meat-meal to be fed in open troughs. If raising young pigs to porker and bacon weights, ¼ lb. to ½ lb. of grain per pig per day would be an excellent ration.

COWS WITH OVERGROWN HOOFS.

D. J. H., Fitzherbert West :—

My cows are from the slopes of Ruapehu, and when I brought them here they had good clean bright hoofs. Now, after twelve months on reclaimed flax-swamp land, they have become very long and flat, besides losing their smooth brightness ; the toes also are breaking off. The land is mostly a stiff silt on peat. Is this mineral deficiency ? Should I put lime in water troughs ?

The Live-stock Division :—

The overgrown nature of the hoofs of your cows, together with the other symptoms you describe, appears to be due to a lack of wear of the hoofs on account of the soft nature of the land upon which the cows are grazing. To prevent the toes breaking off, all overgrown hoofs should be trimmed with a farrier's knife and rasp. The lack of lustre in the hoofs is due to the peaty nature of the soil. There does not appear to be any connection between this trouble and mineral deficiency ; periodical trimming of the hoofs will be necessary while the cows continue to graze on this soft land.

NORTH ISLAND LAMBING ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 86·49 per cent., compared with 83·19 per cent. last year. With 9,247,005 breeding-ewes in the North Island, as shown in the 1931 sheep returns, the number of lambs this season is estimated at 7,998,247. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 24th September to 5th November, 1931, include the following of agricultural interest:—

No. 65157: Gate-opening means; F. and J. Ross. No. 67069: Cream-treatment; S. H. Hartmann. No. 67331: Mixing fertilizer; A. W. Cargill. No. 64415: Centrifugal separator; A. E. Denham. No. 64663: Manure-distributor; J. J. Fenton. No. 65368: Fertilizer-distributor; A. W. Spence. No. 65899: Chicken-trough; E. L. Lees. No. 66118: Teat-cup; H. Walker. No. 66329: Pulsator-releaser; G. S. Gordon. No. 67077: Milking-machine; L. R. Harris. No. 67244: Milking-machine; J. Taylor and Co., Ltd. No. 67573: Dairy installation; Aktiebolaget Separator. No. 67654: Trimming lawn-edges; J. C. Rowe. No. 65241: Manure-distributor; J. Munro. No. 65598: Teat-cup supporter; A. W. Worms. No. 65797: Scarecrow; R. V. Shepherd. No. 65693: Stripping flax; C. E. Mounfort. No. 67239: Tipping-means for cheese-vats; Wilkins Ltd. No. 67650: Cheese-manufacture; W. Nilsson.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

FORTHCOMING AGRICULTURAL SHOWS.

THE following show dates have been advised:—
Otago A. and P. Society: Dunedin, 24th and 25th November.
Stratford A. and P. Association: Stratford, 25th and 26th November.
Poverty Bay A. and P. Association: Gisborne, 27th and 28th November.
Wyndham A. and P. Society: Wyndham, 4th December.
Southland A. and P. Association: Invercargill, 8th and 9th December.
Helensville A. and P. Association: Helensville, 29th January, 1932.
Dannevirke A. and P. Association: Dannevirke, 9th and 10th February.
Masterton A. and P. Association: Solway, 16th and 17th February.
Mayfield A. and P. Association: Mayfield, 12th March.
Methven A. and P. Association: Methven, 2nd April.

PRICE OF STRYCHNINE FOR RABBIT POISONING.

IN connection with the sale of alkaloid powdered strychnine to settlers by the Department of Agriculture for rabbit-poisoning, it has been found necessary to increase the price from 3s. per ounce to 3s. 3d. per ounce, owing to the increased cost of wholesale supplies.

Importation of Animal Manures from India prohibited.—By Order in Council gazetted on 12th November, the regulations under the Stock Act for preventing the introduction of animal diseases into New Zealand are amended to prohibit the importation of animal manures from India. The order comes into force on 1st April, 1932, and does not apply to shipments which may have been dispatched prior to that date.